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Psychological Bulletin

STUDIES IN THE PSYCHOLOGY OF CHILDREN'S DRAWINGS: II 1928–1949

FLORENCE L. GOODENOUGH AND DALE B. HARRIS

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General Reviews and Summaries

More than twenty years have elapsed since the publication in this JOURNAL of a review by Goodenough (105) of the earlier literature on children's drawings. Although other writers have dealt with special phases of this subject since that date and Graewe's (109) *Geschichtlicher Überblick* covers the literature from 1903 to 1935 fairly completely, no recent complete summary, written in English, has come to our attention. Perhaps the nearest approach is the chapter by Meier (199) in the *Fortieth Yearbook of the National Society for the Study of Education* which includes a bibliography of 150 titles, the greater number of which deal with the art products of children. Goodenough's chapter on children's drawings (106) which appeared in the first edition of Murchison's *Handbook of Child Psychology* presents a more detailed discussion of the topic than that given in the earlier article, but this book is now out of print. Less complete reviews and summaries have appeared in connection with many of the books and articles mentioned in later sections of this article.

Of the many discussions of special aspects of the topic, by far the most elaborate and detailed is the series of four articles on the art of the abnormal published by Anastasi and Foley (11, 12, 13, 14). Although the material deals mainly with adults, some data on the art of neurotic and psychotic children and adolescents are included. The chapter on drawing and painting in Bell's *Projective Techniques* (25) includes a table, 25 pages in length, in which the various aspects of drawing noted in one or another of the studies included in his bibliography of 182 titles are summarized together with their presumed clinical interpretation. Bell cautions that drawings must be interpreted as wholes rather than in terms of separate aspects or parts, the meanings of which may change with the circumstances. Probably his table is most useful as a summary of hypotheses to be tested further, rather than as a diag-

nostic or clinical aid. The table includes appropriate references to the bibliography in the case of all entries, but it gives no indication of the comparative dependability of the items. Findings of carefully designed quantitative researches appear alongside shrewd (and sometimes naive) hunches based on single cases. Another summary of projective methods, including painting and finger painting, appears in the monograph by Lerner and others (**162**).

Bell's chapter provides a striking illustration of the rising tide of interest in drawing as a "projective method." The belief that the art of children is primarily a language, a form of expression, is by no means new, but its emphasis has shifted. Earlier studies were for the most part based on the oft-repeated statement: "A child draws what he knows, rather than what he sees." At the present time many students of child art would revise this hypothesis to read: "A child draws what he feels, rather than what he sees or knows to be true." In spite of the charlatans who have exploited the method and others with poor scientific training who have used it unwisely, evidence that the child in his drawings frequently gives outward expressions to his inner life of thoughts and feelings, to his fears and his desires, to his hopes and his frustrations, is steadily accumulating.

Although projective theory has provided the keynote for many of the recent studies in this field, more conventional topics have continued to attract the attention of many persons, especially during the first half of the period covered in this review. Studies of the developmental stages in drawing have confirmed earlier findings and have added many details to the general outline. The use of children's drawings as aids to the solution of various psychological problems, particularly those having to do with visual perception and with memory for what is seen, has become increasingly popular. Many of these reports include fairly comprehensive bibliographies. The use of drawing as a means of studying the divergences of various cultural or racial groups is at least a century old, but the recent studies are more sophisticated both in methodology and in the conclusions drawn. An excellent survey of methods with particular reference to those used in the study of the perception of form has been given by Cain (**50**). The literature on special artistic talent was reviewed by Meier (**194**) a number of years ago and in connection with a later series of studies carried on under his direction at the State University of Iowa (**195, 198**). Other reports have considered such questions as art eduction in the schools, the measurement of ability in art, the extent of art appreciation, and the relation of talent in art to other abilities or personality traits.

The brief accounts of the literature which follow are based upon

reading of the original book or article by one or both of the present writers when the sources were available to them. When the originals were inaccessible, the reports in the *Psychological Abstracts* have been used. In all such cases a reference to the abstract is appended to the citation in the Bibliography.

The Development of Graphic Expression in Childhood and Adolescence

General Developmental Trends. The developmental aspects of child art will be considered first, not only because interest in this topic preceded interest in most of the others in point of time, but for the more important reason that a knowledge of the usual is essential for the recognition of the unusual. Many of the reputedly abnormal features in the drawings of single children or of small, selected groups lose their apparent significance when the age and sex of the subjects and the conditions under which the drawings were made become known.

Both cross-sectional studies of the drawings of large groups of children at succeeding ages and longitudinal studies of the work of a single child over a period of years have been employed to examine typical age changes in the form and content of graphic expression. Eng's very complete and detailed study of the drawings of her little niece, originally published in German, is now available in English translation (**83**). Hildreth's study (**127**) of more than four thousand drawings made by a boy between the ages of two and eleven years adds a third to the list of intensive studies of the drawings of individual children that have appeared in the literature. McCurdy's study (**181**) of more than one thousand drawings made by a boy between the ages of two and one-half and seven years will be referred to later in this paper since it relates only to the Goodenough technique of scoring the drawings of a man to obtain an estimate of intelligence.

Hildreth's monograph is of interest for several reasons. In the first place the drawings were made by a boy whereas the children studied by Luquet and Eng were girls.[1] More than half of the drawings made by the boy were attempts to depict trains; those made by the girls in the two earlier series were chiefly pictures of human beings, houses, animals, trees, and flowers. The difference in content renders it possible to examine the three sets of data in terms of their psychological aspects rather than in terms of their particular details. In analyzing the train drawings made by her subject, Hildreth lays particular stress on the "wholeness" of the concept which the child was attempting to depict. At no time was there evidence of a building up of the whole from isolated parts; always the *train* was primary. As knowledge of the various parts and their functions increased and became more specific, these parts were indicated

[1] For a brief account of these studies see References **83** and **176** of the Bibliography at the end of this article.

with greater accuracy of form, position, and number. A growth curve is presented, showing the accumulation of new features added each year. As has been found true of most developmental traits, improvement is most rapid during the early years, with negative acceleration becoming clearly apparent after the age of five. Although Hildreth emphasizes the evolutionary character of the changes that occur with advancing age, she nevertheless outlines sixteen stages in the development of the train drawing, each of which is marked by the appearance of some characteristic features not previously noted. In spite of the differences in subject matter, these changes are quite in line with those previously noted by Rouma, Luquet, Eng, and others.

The hypothesis that, in drawing, children proceed from the whole to the parts is not entirely confirmed by Barnhart (19), who constructed an ingenious device for studying this problem. It consisted of a frame in which the drawing surface covered a sheet of carbon paper which, in turn, covered a long sheet of paper wound on a roller. At intervals of one minute, while drawing, the subject was asked to pause while the lower paper was pulled out to the length of one panel. This made it possible to determine the order of drawing. Fifty-two children between the ages of five and sixteen years were asked to make a picture of children playing in the snow in a park. Some children, chiefly the older ones, began with a broad outline of the entire picture and later filled in the details; but the younger children more frequently completed each detail separately before passing on to the next. The complexity of the subject is likely to have been a contributing factor in this case but it would be interesting to know what characteristics other than age differentiated the two groups. Barnhart also examined the manner in which space was depicted by children of different ages. His findings are very similar to those obtained by Stern and others many years ago. At first there is no apparent concept of graphic portrayal of space. Objects are scattered at random over the paper.[2] This is followed by a linear form of representation in which objects are arranged in a row, usually upon a ground line. Next comes a period of ranked space in which there are two or more such rows with the ground lines in the background either straight or curved to indicate relative distance, but showing only rudimentary ideas of perspective. A transitional period follows leading to the final idea of "true space" with recognition of such factors as perspective, partial concealment of objects in the background by those in the foreground, foreshortening, and the like, although lack of skill may lead to very crude ways of depicting these factors.

Variations in style resulting from differences in the manner of apprehending part-whole relationships at different ages were studied by

[2] Even at this stage, association between persons or other objects is shown by placing them near each other or even in juxtaposition, but the concept involved seems to be that of a functional relationship, rather than that of position in space.

Kobayashi (**145**) and by Martin (**192**). Both found that with advancing age there is an increasing tendency to perceive an object or figure as a differentiated whole, rather than as a conglomeration of parts. Much the same results are reported by Katô (**139**) for Japanese kindergarten children who were asked to draw from a doll-model of a man placed before them. At first only the main parts were drawn, then details were added, until finally the concept of the figure as a whole with differentiated parts was indicated.

The prerepresentative stages of drawing or scribbling have received more attention during the past twenty years than formerly. Seeman (**271**), Schilder (**265**), and Bender (**26, 28**) stress the importance of the early circular movement—the "whorl"—which Seeman finds to be equally characteristic of the drawings of all infants or young children, regardless of race or culture. The whorl gradually evolves into the "stick-man" in which the circle still predominates but to which various appendages are added in accordance with cultural influences. The apparently universal character of the "whorl" leads Read (**254**) to a rather curious theory of the development of child art which appears to be a mixture of the descriptive accounts of the early writers on the subject with psychoanalytic theories and typology, particularly that of Jung. He advances the theory of "primordial images" exemplified by the circle, the whorl, and radiating lines appearing in the drawings of young children, and believes that these forms represent "electrostatic patterns produced in the cortex by normal phenomenal experience" (p. 189). To the present writers, this does not appear to add much to the generally accepted belief that not merely drawing but behavior of all kinds is mediated through cortical action.

To the very young child, "writing" and "drawing" are much the same. Legrün (**159**) describes a series of developmental stages by which the two forms of graphic expression become differentiated. The progress is from completely unorganized scribbles with no apparent design to forms of a more characteristic shape with occasional attempts at letters of the alphabet. Hildreth (**126**) also reports the early stages of handwriting shown by 170 children between the ages of three and six years. She is able to differentiate seven levels of progress beyond which further improvement seems to involve mainly a higher degree of accuracy, neatness, and speed of writing. Both Legrün and Hildreth note that letter-like forms usually appear earlier than true letters and that irregular scribblings tend to give place to arrangement in forms of lines or rows as the concept of writing is evolved.

The X-ray effect in drawing and confusion of full face and profile, which have been noted as immature or transitional stages in achieving representative drawing, receive a different interpretation from Lassen (**158**). He assigns these effects to the expression of a creative urge which expresses itself, with age, in a freer organization of the objective relation of things. Inasmuch as both of these characteristics are found more

frequently in the work of feebleminded than of normals of the same mental age, the present writers are reluctant to accept his term "creative" in its ordinary meaning.

Among other investigations in which the findings have resulted mainly in a reiteration of developmental trends previously observed, may be mentioned the work of Beach and Bressler (**22**), Hetzer (**124**), and Zambaldi (**326**), who have emphasized that developmental tendencies be considered when planning a program of art education for children. A similar viewpoint has been expressed in many brief articles and reviews in encyclopedias, educational journals, and the like not mentioned here.

Developmental Direction and Orientation in Drawing. The development of directionality in drawing was the subject of an extensive investigation by Gesell and Ames (**102**). Approximately fifteen hundred drawings were secured from children between the ages of eighteen months and seven years, most of whom were tested semi-annually, and from twelve adults. The tasks included drawing a vertical and a horizontal stroke in imitation of the examiner and drawing a cross, a circle, a square, a rectangle with a diagonal, and a diamond from copy. Of the reported findings, the following seem most reliably established: (a) For both the vertical and the horizontal strokes the average length of line increases as age advances. This probably reflects more purposeful action as well as improved control in use of the hand. (b) Symmetry in the form of the cross improves with age as does the tendency to make the cross by means of two intersecting lines instead of drawing one or both half-lines to the point of intersection and completing the figure by means of a separate line. (c) Younger children commonly draw both the square and the diamond by means of four separate lines. Older children and adults usually draw the square by means of a single continuous line but are likely to use four downward strokes for the diamond. The article also notes the usual errors in copying the square and the diamond, but these are too well known to require description here. No consistent relationship between directionality and handedness is indicated. Rice (**256**), however, who had 293 subjects ranging in age from two and one-half to fourteen years copy the diamond both in the horizontal and the vertical position, found that right-handed subjects commonly follow a clockwise system in making the strokes. Although her number of left-handed subjects was too small to yield highly dependable results, the indicated trend is in the opposite direction. Other findings are similar to those obtained by Gesell and Ames. Hicks and Ralph (**125**) found no reliable difference between the final performance of an experimental group of nursery school children who were required to trace the Porteus Diamond Maze twenty times with the preferred hand and that of a control group who traced it only six times. As a matter of fact, the latter did slightly better than the former; a fact

which may be attributed either to chance or to loss of interest on the part of the experimental group.

Orientation in the direction depicted in the drawings of railway trains by kindergarten and primary grade children in Japan and Formosa was studied by Iinuma and Watanabe (**136**) who present the following figures: Out of a total of 1,648 drawings, 26 were front views and the direction of 105 could not be determined. Of the remainder, more than 80 per cent were shown as running toward the left. Hildreth (**127**) reports a similar tendency in the drawings of the boy whom she studied but does not give exact figures. Unwillingness to cover their work with the hand that holds the pencil on the part of children of whom the majority are right-handed, seems the best explanation for this tendency. This point has been particularly stressed by Østlyngen (**236**). A similar trend has been noted in drawings of animals and in profile drawings of human figures. Both usually face toward the left. Zesbaugh (**327**) notes this in her analysis of more than ten thousand drawings of a "mail-man" made by elementary school children. She notes also that purely schematic drawings have pretty well disappeared by the time the children reach the fourth school grade and that some attempts at depicting the special characteristics of the postman's uniform appear as early as the second grade. Further developmental trends similar to those noted by other investigators are also reported.

Graewe's very intensive study (**107**) of over six thousand drawings by subjects ranging in age from the preschool to the adult level included both free drawings and drawing from a model with later reproduction from memory. His treatment of the data is descriptive only; there are no tables and few quantitative statements of any kind. However, his long and intensive study of the problem enables him to make many keen observations with respect to developmental changes relating to such matters as the tendency to perseveration, the trend toward concreteness, the manner of representing space or perspective, foreshortening, and the like. In a second study (**108**) Graewe examined the developmental changes in the child's manner of depicting animals. At first there is no distinction between the animal drawing and the drawing of the human figure; the child differentiates them only by naming. Later on a change in orientation appears, with the animal's body usually placed in the horizontal position, the human figure in the vertical position. Still later some distinguishing appendage is added, such as a tail or a larger number of legs which in time is reduced to four. In the final stage, emphasis is placed on the total outline; the animal is an animal from the start. Kerr (**140**), who studied children's drawings of houses, found few consistent qualitative changes with age, but a general improvement in symmetry and in the neatness of lines and angles. The absence of marked qualitative differences is probably attributable to the wide variance in the type of houses with which children are familiar. On the other hand, Neu-

bauer (231) reports that adolescents, when asked to decorate and complete an outline drawing of a teapot, show a distinct age progression in use of color, geometric patterns, composition, and the emergence of idealistic and realistic types. These findings differ markedly from those generally reported for adolescents who show no particular aptitude for graphic art.

Cases of inversions in the orientation of children's drawings are reported by Belart (24), Billing (35), Gerald (101), and Pearson (240). For the most part, interpretations follow those generally given for inversions in the writing of young children. Although Pearson regards these cases as being extremely atypical at the ages specified (five and six years), they are actually less uncommon than he supposed. Many children, like some of the more primitive groups described in another section of this paper, have difficulty at first in identifying the idea of "up" with the top of the paper.

Child Art: Drawing from a Model. A number of persons have been interested in the character of the changes made when a child attempts to reproduce a design from copy, either directly or from memory. Graewe's (107) study has already been mentioned. By far the most elaborately analyzed of these studies was made by Portocarrero de Linares (248), whose subjects were 1,375 girls from the public schools of Lima, Peru, ranging from kindergarten through "preparatory" to Grade VI, eight levels in all. Each subject was asked to copy a series of eight designs which were printed on the test blank. Most of the designs were highly conventionalized representations of common objects such as a table or a fish. The results are presented by grade levels rather than by ages. The following eight categories are considered: (1) Entirely correct reproduction, (2) correct except for minor errors in proportion or symmetry, (3) amplification, i.e., the addition of elements not present in the model, (4) simplification, (5) deformation, (6) broken structures in which elements that should have been connected are drawn separately, (7) concretization, in which changes were made in the conventionalized figure in order to bring about a closer resemblance to the real object, and (8) confabulation in which the subject apparently drew pictures at will, with no attempt to copy the model. As might be expected, a general improvement with advance in school grade is noted for all the models, but a comparison of changes in the various categories is interesting. In all grades and for all models, simplification is much more common than amplification. In Grade VI, for example, the relative proportions are 12.9 per cent to 0.6 per cent. Concretization and confabulation are largely confined to the kindergarten and preparatory classes except in the case of the much-conventionalized fish, for which the percentages in the former category continue to make up an important percentage of the total throughout the first four grades. Portocarrero de Linares emphasizes as does Hildreth (129),

who conducted a similar experiment with four-year-old New York City children, the tendency to simplify that which is too difficult or to give meaning to that which is meaningless. Sorge's (**279**) work with rural and urban European children and Homma's (**131**) with Japanese children lead to a similar conclusion and suggest that the tendency may be well-nigh universal. Paulsson (**239**), it may be remembered, found the same thing to be true for adults.

Burkhardt (**48**) describes an experiment in which a comparison was made between the attempts of children to copy drawings of familiar forms with their copies of meaningless figures having approximately the same number of lines and angles. Alterations of form, which in Burkhardt's opinion represent "improvements" from the child's point of view, were much more common in the first instance than in the second. Apparently, unless a child is able to see some meaning in a figure at the start, he is not likely to try to improve upon it. Although Portocarrero de Linares does not classify her figures with respect to their meaningfulness, it may be noted that her Models II and VIII, which to us seem to be the least abstract in her series, do tend to show more alterations in the direction of concreteness than the others.

It is apparent that no universal statement can be made with respect to the relative tendency to add or to omit elements in drawing, for this will vary with the difficulty and meaningfulness of the material. Moreover, difficulty and meaningfulness are not absolute factors, but depend on the level of development of the subjects. Under some conditions, simplification may be rare and amplification for the purpose of giving a more obvious meaning may be the rule. Burton and Tueller (**49**) found this to be the case when they asked children of nursery school age to copy a circle with three dots so arranged within it as to suggest a face. The subjects were urged to make successive copies until they refused to make more. The prototype of this "satiation" experiment is, of course, the work of Lewin (**166**), who compared the performances of normal and feebleminded children. Bender (**27**) conducted a similar experiment with children suffering from organic brain damage. All these investigators find that when it serves to give concrete meaning to the relatively abstract symbol, the tendency to amplify is more common than the tendency to simplify. Apparently, however, this is the case only when the original stimulus is well within the child's ability to copy, and seems to him an imperfect or incomplete representation of the object he conceives it to depict.

In spite of the complexity of the task of discovering under which conditions children amplify in copying designs and under which they simplify, more research should be done in this area. The work of Engerth (**84**), of Vedder (**302**), and of Bender (**27, 28**), suggests that brain damage in children as well as in adults may be indicated by distortions in drawing and copying. Mira's Myokinetic Psychodiagnosis

(206), although promising for work in this area, has apparently not been tried out with children. The Ellis visual designs, similar to Bender's figures, have been used with children by Wood and Shulman (323) and by Lord and Wood (171). From these studies it is clear that a great deal more must be learned about the distortions which are characteristically introduced by the immaturity factor in drawings of normal children of different ages before we can be warranted in drawing conclusions in respect to their meaning for the abnormal.

Rostohar (258) had elementary school children reproduce from memory a number of designs, some of which were in black and white, others in color. After each unsuccessful attempt the original was again exposed and a new trial given. This was continued until an approximately correct copy was made or until it became apparent that no further improvement was likely. Examination of the successive trials showed that two different methods were employed in building up the memory image. Some children proceeded from the general contour to the details while others worked from the parts to the whole. Retests at weekly intervals indicated that the process of forgetting followed in reverse order the same general plan as the process of learning. Children belonging to the first group lost the details before the general form was forgotten; those of the second group retained details after the main figure could no longer be recalled.

Two papers by Slochower (277, 278) describe the attempts of children between the ages of five and ten years to reproduce line drawings of geometrical figures in each of three media—pencil drawing, clay, and Tinker Toy. The younger children kept to the two dimensional forms shown in the models with only such minor variations as were necessitated by the medium used. Children of nine and ten, however, showed a definite tendency toward the construction of three-dimensional forms when the clay and Tinker Toys were used. Slochower also found, as have others, a definite tendency to simplify the more difficult forms and an increase, with age, in accuracy of reproduction. Nakae (218) posed the task of copying a solid model of a cylinder for four- and five-year-olds. The abstract does not indicate that any attempt to depict three dimensions appeared.

Lark-Horovitz (154), who compared children and adults with respect to their ability to draw a series of models from memory, found that although on the average the adults did better than the children, there were many who drew schematically as children do. She comments particularly on the "interlinkage" of different sensory modalities in producing the memory image because of which the drawings of different persons will vary in accordance with the particular type of sense impression that was dominant at the time the image was formed.

Child Art: Formal Elements. Ellsworth (82) utilized the free easel paintings of 20 nursery school children as a means of studying the early

stages of compositional design, particularly with respect to the relative use of line and mass. She found that if design was apparent, it most frequently took the form of a simple element placed in rows, columns. concentric circles, or in attempts to reproduce figures. Lines were more often used for the figures; mass more often when filling in the background. A more extensive study in this area was made by Cockrell (57), who collected 1,550 paintings from three nursery schools, with a total enrolment of 60 children between the ages of twenty months and six years. Cockrell reports that the devices most frequently employed for graphic expression were contrast and opposition, which occurred in almost every painting; balance of line, mass, or color, which was observed in 637 paintings; repetition, which was noted in 262 instances; rhythm of movement found in 180 cases; and symmetry, found in 93 instances. All examples of the group last named were made by the same thirteen children. Unfortunately little information is given with respect to the abilities and personality traits differentiating these subjects from their classmates. Cockrell concludes that drill in design is unnecessary for young children.

Haubold (121) approached the question of children's appreciation of style by a more objective method than those frequently used. He utilized photographic copies of pictures by different masters. In each set of pictures the subject matter of all the paintings was similar but the artists differed. Children were shown two sets at a time and asked to match the pictures they thought had been made by the same person. Success improved steadily from 35 per cent at the age of eight years to 52 per cent at the age of sixteen. We have not seen the original of this article and the abstract, unfortunately, does not provide the information needed to determine how far these figures exceed chance. It would be worth while to repeat the study with American children.

Child Art: Foreshadowing "Projective Methods." Biber's study (34) of the drawings of children in the Bank Street School not only enabled her to verify many of the conclusions as to developmental trends reached by her predecessors, but also led her to draw certain conclusions with respect to the indications of personal-social characteristics shown in the drawings made by individual children. As is true of many such studies, however, the line between correlation and coincidence is not sharply drawn.

Luquet, whose many and valuable studies in the field of children's drawings are too well known to require much discussion here, after reaffirming and amplifying his earlier position in two articles published in 1927 and 1929 (175, 176) turned his attention to a problem that had long interested him—the relation of child art to primitive art (177). The two articles first cited are of interest chiefly because in them he places particular emphasis upon what he calls the stage of "intellectual realism," where his discussion definitely foreshadows the modern "pro-

jective methods." Lowenfeld (**174**) gives an account of the progressive stages in the development of drawing which in many respects is very similar to that outlined by Luquet, but like most of the modern writers he places even more stress upon the subjective aspects of the drawing than did Luquet. He points out that the drawings of the young child reflect his own desires, feelings, beliefs, and fancies rather than objective reality. Proportions, for example, represent values as the child conceives them rather than absolute size. Later on, as the child moves into what Luquet designated as the final period, that of realistic representation, his self-confidence is shaken (so Lowenfeld believes) by the contrast between his internal and his external worlds. He may then give up all forms of creative activity or he may express his conflicts and confusions by the character of his art products.

Finger painting has appealed to a number of persons as offering unusual opportunities for expressive work because of the direct and primitive character of the method of working with the material. A bibliography of work on this topic has been prepared by Napoli (**220**). Blum and Dragositz (**38**) attempted to study its developmental aspects by a comparison of the work of first-grade and sixth-grade children. Unfamiliarity of both groups with the medium may perhaps account for the fact that so few differences were found. The older children obtained somewhat neater results with less smearing of the colors at points of junction and better covering of the paper. Even these differences, however, were so small that two teachers of art who served as judges were unable to separate the work of the two groups with much better than chance success.

In her study previously mentioned, Cockrell noted that in practically all of the drawings made by the older children of her group, evidence of an idea or purpose was apparent. Hatano (**120**) found that young children were more free in their attempts at graphic representation of a story told to them than in their attempts to reproduce it verbally. Scheer (**264**) tabulated the subjects voluntarily drawn by adolescent boys in an attempt to ascertain the dominant interests characteristic of this period of development. Although his method of classification differs from the methods employed by earlier writers, its objectivity is open to serious question. Scheer made use of three broad categories as follows: drawings presumably inspired by observation of nature, those arising from personal experience, and those inspired by imagination or fancy. Examples of the first group include landscapes, houses, and the like. The second group includes pictures of baseball and other games, labelled or otherwise named pictures of known persons or animals, and so on. The third group includes decorative designs, fancy heads, etc. The implication that generalized patterns of interest may be inferred from evidence such as his is of doubtful validity.

Shaffer (**273**) compared the ability of public school children to in-

terpret newspaper cartoons and found a steady improvement from Grade IV to the end of the high school period. This probably reflects an increasing acquaintance with public affairs quite as much as mental development.

The Psychology of Drawing: General Theoretical Material. Among the more recent theoretical discussions of the developmental aspects of child art may be mentioned the work of Schaefer-Simmern (**263**), who bases his conclusions on the examination of the drawings of several hundred children. In its terminology at least, his position is unlike that of most other writers on the subject. He holds that a child's drawing is dependent upon a process which he calls "visual conceiving" which is based on perception rather than on abstract thinking, and which conforms to the principles of gestalt psychology. He regards visual conceiving as an emergent process, in which respect it resembles intelligence, but he maintains that it is a process in its own right, not a manifestation of intelligence, a form of language, or a medium for the expression of emotions. His comparisons with gestalt theory are, of course, not new. Similar statements have been made by many others, notably Hildreth (**127**) and by Bender (**26, 28**).

Schilder (**265**) objects to the use of the word "symbol" or "symbolic" as applied to the majority of children's drawings. He considers that such terms are appropriate when the sign or symbol is used as a means of conveying a meaning that is distinct from the manifest content. He maintains that most of the drawings made by children are overt attempts to depict reality; they become covert or symbolic only when the normal expression is blocked.

Cameron has advanced the remarkable contention that "in the normal person there is an arrest of development and often a decline during the age-period between eight and ten years" (**51**, p. 181). As evidence he cites the growth curve published by Peck (**241**), who found that scores on her drawing test improved most rapidly during the early years with negative acceleration becoming fairly marked after the age of seven or eight. This is quite in accordance with what has generally been found for most mental traits, although in this case it is possible that a more exacting method of scoring the test might have delayed the flattening of the curve to some extent.[3] Cameron's statement seems to neglect the leveling-off in growth of most aspects of ability and behavior incident to the approach of maturity. He ascribes this "decline" to the competing influences of group play and other social factors. There may be a lessening of interest in drawing at about that age though we have

[3] The test used is described in a later section of this article.

seen little evidence to support such a conclusion. Certainly the *ability* to draw does not decline but continues to improve until maturity, although changes are small after the periods of early and middle childhood have passed.

Griffiths' study of imaginative expression in children (112) includes an interesting chapter on the early stages of drawing. She notes that after the scribbling stage has passed, the child is likely to center his attention upon the representation of a single object which he draws repeatedly until his work is reasonably satisfying to himself. Later he begins to add other objects pretty much at random; he is still engrossed with the problem of representing objects as such, not with making a synthesized picture. Only later does he begin to represent a theme as a whole. Fordham (97) has applied the psychoanalytic theories of Jung to the interpretation of child behavior. Two chapters of his book are devoted to drawing. He holds with Jung's theory of "archetypes" and believes that drawings, like dreams, show a mixture of outer and inner experience. Even the scribbles of the very young child have meaning, but this must be interpreted in terms of the content. Like Seeman (271) and Read (254), he attaches special significance to the circular movements known as the "whorl," which a number of people have observed to be characteristic of the early stages of drawing or scribbling. Lange (153) emphasizes the subjectivity of the art work of the preadolescent as compared with the relative objectivity and greater self-criticism characteristic of the postadolescent. Others have called attention to this point, and have noted that this change in attitude reduces the value of drawing as a means of personality diagnosis or at least renders such diagnosis much more difficult for older than for younger subjects.

The studies thus far described have depended in the main upon observation and description as methods of classifying their data. Quantitative results, when given, have consisted chiefly of simple percentages; in many cases only illustrative instances have been given to support the conclusions drawn. The investigators, for the most part, have been little concerned with questions of the relative merit of the drawings they examined; rather, they have sought to ascertain how children draw, in what ways their drawings change with advancing age, and, most of all, why they draw as they do. Others have been more interested in the use of drawing to throw light on problems of general psychology, particularly those having to do with visual perception and apprehension, and the changes in these processes that take place with the passage of time.

There are, however, many teachers and supervisors of art who recognize the fallibility of human judgment and seek to find better and

more objective ways of measuring the quality of the art products of children. This search has led to the development of a number of devices designed not only for measuring achievement in art, but also for predicting artistic aptitude and for appraising art appreciation. Others whose interest centers primarily about the field of measurement have studied the reliability and validity of some of the scales already published or have attempted to ascertain whether or not their usefulness can be extended to fields other than those for which they were originally designed. All this has resulted in a fairly large body of literature devoted primarily to methodology, rather than to questions of development and behavior, for which the answers will obviously depend on the accuracy and freedom from bias of the methods used for their solution.

Methods Used for the Study of Children's Drawings

Methodological studies of art products may be classed under several general headings as follows: (1) those designed chiefly for the appraisal of the artistic merit of a piece of work or the degree of artistic appreciation possessed by a given subject. These include chiefly objective tests, formalized rating scales, and objectively defined methods of classification, as well as some simple types of apparatus such as that used by Barnhart (19) which was described in the preceding section of this paper; (2) studies of the Draw-a-Man technique; and (3) new methods of observing, recording, classifying, and evaluating children's work, and of scaling art products in at least a reasonably objective manner with a view to learning something about the personality or abilities of the young artists. Only a few of the "projective" methods have been included in this group, since these studies for the most part have made use of intuitive rather than objectively defined procedures for their interpretations. The greater number of these articles are discussed later in this paper.

Scales and Tests. Among the tests and scales designed for measuring achievement in art may be mentioned the second of the two Kline and Carey scales (143) which is intended to measure the quality of design shown in posters, decorative borders, and similar compositions.[4] The method of deriving the scale values was the same as that used by Thorndike in 1913. Doms (67) also devised a scale of this kind, but this we have not seen. The McAdory Art Test (178), which requires the subject to judge the relative merit of the four plates comprised in each of a series of seventy-two items, was standardized on the basis of the ratings given by one hundred judges, all of whom were recognized artists, art teachers, or art critics. Although intended for use over the

[4] The first of the Kline and Carey scales which was designed for the measurement of free-hand drawing was described in an earlier article (105).

entire range from first grade through college, it is not well suited to the younger ages. Voss (**306**) has prepared a modified form of the test intended for use in grades below the fourth. The major difficulty with the McAdory test, however, as a number of its critics have pointed out, lies in the fact that so many of the pictured items have to do with costumes, automobiles, utensils, and the like for which styles change rapidly with the passage of time. Although the practical and homely nature of such a test appeals to many, it is questionable whether the basic principles of good design are likely to be recognized under so heavy an overlay of circumstantial and temporary factors. The Meier-Seashore Art Judgment Test (**200**) avoids this difficulty by utilizing pairs of sketches, one of which conforms to some well-recognized principle of composition or style, while the other violates it. By utilizing copies of the works of the great masters which have already stood the test of time, the validity of the test is, in a sense, guaranteed. The test can be used with children as young as the junior high school age, but is better suited to the senior high school or the college level. Several other tests suitable for the measurement of art appreciation or achievement at the higher age levels have also been devised, but since they involve little that is new in the way of method are not mentioned here.

Lark-Horovitz and her associates at the Cleveland Museum of Art (**157**) have developed a series of samples illustrating various degrees of merit in different types of children's drawings. These samples do not constitute statistically graded scales; they are arranged only in presumable order of merit. They are designed primarily as an aid to teachers of art who are interested in grading the work of children. Peck's (**241**) scale, mentioned in a preceding section of this paper, was designed for the prediction of school success and is probably as good a measure of intelligence as of ability in drawing. The method is interesting. It requires the subject to copy photographs of common objects by means of a pencil. Scoring is in terms of points assigned for the representation of each of a number of specified parts. More conventional is the type of scaling used by Kerr (**140**) in her study of children's drawings of houses and by Tiebout (**295**) for the measurement of children's paintings, both of whom developed their scale values on the basis of differences equally often noticed by presumably competent judges. The Horn-Hellersberg Test (**123**) consists of twelve squares into which lines derived from test pictures by Carl Horn[5] are to be incorporated in such a way as to form a picture. The test may be used with adolescents. Hellersberg believes it to be a rather sensitive indicator of the subject's adjustment to reality, but the evidence for this contention is as yet incomplete.

The Draw-a-Man Technique. After a preliminary survey of methods (**232**), Oakley devised a measure of the drawings of a man made by adolescents (**233**). This scale may be looked upon as an extension of the Goodenough Draw-a-Man Test which appeared in 1926, designed for use only in the kindergarten and primary grades. An interesting feature of Oakley's scale, if it is proved to be valid, is a measure of egocentricity which is based upon the ratio of points most frequently scored by children of a given age to those less often scored. The idea is plausible but requires further confirmation. A number of M.A. theses done at Columbia University (**58, 74, 79, 103, 164**) have been devoted to the general topic of ascertaining the usefulness of the Goodenough test for subjects

[5] The Horn Art Aptitude Inventory on which this test is based was devised primarily for use in art schools rather than for use with children in general.

older than those for whom it was originally designed. These we have not seen. Berdie (**32**) reports a correlation of .62 between Goodenough and Wechsler IQ's with older adolescents of average and below average ability.

Wintsch (**317**) reports an extensive study of children's drawings of the human figure and gives norms for French-Swiss children. He has also used the Fay test with various groups of European children, as have Fontes and others (**96**) and André Ray (**252**). The Fay test consists of asking a child to illustrate the situation, "A lady takes a walk and it rains." The subject has five minutes to complete the drawing. Scoring is by a system similar to Goodenough's. André Ray does not find the measure useful after age twelve; Wintsch suggests the age of nine. Ray (**253**) has also experimented with drawing piles of small wooden cubes from different angles as a test of mental development. The merit of this test, he believes, lies in supplying a concrete model, which reassures the timid child who may lack imagination. The author's confidence in children's ability to draw from a model is not supported by the findings of others that the presence or absence of a model makes very little difference to young children. Prudhomme's (**250**) more extensive and critical work is based on several thousand subjects from three-year-olds to the adult level, who drew human figures, animals, and geometric figures.

The reliability and validity of the Draw-a-Man Test has been the subject of a number of investigations, of which the most thoroughly controlled was carried out by McCarthy (**179**), who gave the test to 386 children in the third and fourth grades in New York City schools on two occasions with an interval of one week between the two administrations. Scoring was done by graduate students after a period of preliminary training. Each drawing was scored three times: twice by the same person and once by a different person. The correlation between self-scorings was +.94; between scorings by different persons, it was +.90. Self-correlation by the split-half method was +.89; by the retest method it was +.68.[6] Williams (**314**), who had one hundred drawings scored independently by five examiners, found intercorrelations between scores ranging from +.80 to +.96. The correlation with the Stanford-Binet was +.65. McElwee (**182**), working with subnormal children fourteen years of age, obtained a correlation of .72 with the 1916 Stanford-Binet. Yepson's (**324**) findings for feebleminded subjects indicate a retest correlation of approximately +.90, but a correlation with the Binet of only +.40.

McCurdy (**181**) obtained drawings of a man from fifty-six first-grade children on two occasions, separated by about three months. The two sets of scores derived by the Goodenough technique correlated +.69, and the mean IQ equivalents differed by a very small amount, statistically insignificant. Of particular interest is the collection of over one thousand drawings made by a boy subject in this study between the ages of two and one-half and seven years. This collection was made available by the parents when they learned of McCurdy's study. Fifty-six drawings of men were selected from this collection, the majority of the complete human figures available, excluding a number "because they were obviously intended as comic distortions or were obviously not done with the usual amount of care." The IQ scores for these drawings averaged 171 with an SD of 22. The two drawings obtained at school differ somewhat in IQ score and correspond roughly with values obtained from draw-

[6] The average of the three scorings was used as the basis.

ings made at home at about the same time. Likewise two Binet tests show a direction of IQ difference paralleling Goodenough IQ's obtained from drawings made at home at about the same periods. McCurdy concludes that variation in Goodenough scores rests upon fluctuation of ability which is more than "error of measurement," and that, in this instance, variability of the individual and variability of the group are of about the same magnitude. Unfortunately, individual and group variability are not comparable when mean performance differs so greatly. Only one of the fifty-eight IQ determinations for the boy fell below about the 97th percentile of general norms.

A series of growth curves showing progress on the Draw-a-Man scale when the counted items or "points" were reduced to equally spaced units according to the Thurstone method of scaling was constructed by Williams (316), who found that the growth of children whose school progress had been rapid, average, or slow was very similar in pattern, though proceeding at different rates. All three curves show fairly marked negative acceleration.

A number of studies have dealt with the question of factors affecting success in drawing the human figure. Ames (6, 7) found that children under the age of five depicted more details when adding to an incomplete figure than they did when told merely to draw a man, but that the reverse was true with children over five. However, the Gesell incomplete man, which was the model used, does not suggest the need of many details for its completion. A more sophisticated drawing might have yielded very different results. The *number* of parts added to the incomplete man (6) shows a more consistent and steady age relationship than do the data relating to specific parts added. This conclusion is in definite agreement with the basis of the Goodenough test.

Gridley (111), with four-year-olds as subjects, compared the results of nine prescribed drawing situations. The children were instructed: (1) merely to "draw a man," (2) "a little man," (3) "a big man," (4), (5), (6) repetitions of (1), (2) and (3) in that order, (7) a schematic drawing of a man from copy, (8) drawing a man from dictated instructions given one at a time as the children drew the different parts, and (9) drawing after the same instructions as were used in (8) had all been given. When scored by the Goodenough method the averages for all except Situation 8 were very similar, but, as might be expected, the dictation of what was to be drawn brought about an appreciable increase in the score, although neither the provision of a copy nor previous instruction had much effect.

Mott (213) used the Goodenough scale to compare the drawings made by fifty-eight children between the ages of four and seven years when the instructions given were simply to "to draw a man," with drawings made when the instructions were to draw a policeman, a farmer, or a cowboy. The majority of the children did better under the first type of instruction, apparently because in drawing the more distinctive figures their attention was diverted to the specific features of the costume instead of being centered on essential aspects of the human subject as such. In another study (214), Mott investigated the effect upon drawing scores of previous movements of specified parts of the body. Drawings were first made with only the general instruction to draw a man. Later the children were put through a series of exercises involving special parts of the body, verbalizing as they did so, e.g., "This is my head, I nod it." Drawings made immediately afterward showed that the exercised part was not only more likely to be shown but was drawn with more care for details. Two previous

studies by the same author (211, 212) utilized drawings of the human figure done on three successive days with slightly different instructions on each day. The drawings were rated for five characteristics. Correlations with various other measures were of about the usual magnitude. The most interesting feature of these studies is that in each a fairly high correlation between ratings on the amount of activity shown in the drawings and those obtained on the Marston Scale for rating introversion-extroversion appears. Because of insufficient data concerning the character of the ratings and the age-range of the subjects, corroboration of the findings is needed.

Israelite (137) compared the relative difficulty of the items on the Goodenough scale for normal and mentally defective children of the same mental age. In general, the defectives surpassed the normals in respect to the number of details shown, while the normal children excelled on items involving the correct organization and proportion of the parts. Earl (75), who compared the drawings of adult defectives with those of normal children, found much the same thing to be true. Spoerl (281, 282), likewise, found that retarded children showed more details in their drawings than did normals who earned comparable total scores, but their sense of proportion was very poor. McElwee (183), who compared the profile drawings of normal and subnormal children, found that although the latter depicted more details than the former, the number of incongruities resulting from confusion between the full face and the profile position was much greater in the drawings made by the subnormal than in those made by the normal children. McHugh (185, 186) made an item analysis of the Goodenough scale with view to shortening it. He discovered that thirty of the fifty-one points in the scale correlated significantly with his criterion—the Stanford-Binet. His findings with respect to the abbreviated scale, however, are questionable, inasmuch as he used the same group of subjects to validate the new scale as were used for the original derivation. He also found that significant IQ gains were registered on a second drawing of a man after an interval of a few months and concluded that the drawing of a man is not free from the influence of experience.

Springer (285) made an item analysis of the Draw-a-Man scale to ascertain which items differentiate between maladjusted and well-adjusted boys as classified by the Haggerty-Olson-Wickman Scale. Of the 51 items included in the Goodenough scale, 15 showed critical ratios of 3.00 or higher. It is interesting to note that the pattern of the differences is the same as that found by those who have compared normal and retarded children; this in spite of the fact that the two groups were equated for total score on the drawing test. Berrien's (33) study, discussed later in this paper, attempts an item analysis to obtain a diagnostic measure of different types of behavior disorder in children. The possibility of using the Draw-a-Man Test as an indicator of maladjustment was also studied by Brill (41), who found that his maladjusted boys typically scored lower on this scale than they did on the Binet while the reverse was more often true of the well-adjusted. His attempt to devise a short form of the drawing test for the purpose of predicting maladjustment commits the too-familiar statistical error of using the same data for validating as for deriving the scale. It is time that prospective test-makers learned better than that!

Bender (29) used the Draw-a-Man Test with a small group of children suffering from post-encephalitic behavior disorders. In each of six reported cases, the IQ obtained from the drawing is far below that obtained on the

Binet. Bender's interpretation is that the cerebral damage had caused a considerable disruption of the body-image and suggests that so marked a discrepancy between the two scales may afford a useful hint as to the possibility of brain injury.

One of the best studies of the comparative performance of delinquent and non-delinquent subjects on the Goodenough test was made by Hinrichs (**130**). Unfortunately, his subjects (ages 9 to 18 years) were for the most part older than those for whom the scale was intended. Hinrichs attempted to remedy this difficulty by devising an upward extension of the scale but found, as have others, that the added section was neither as reliable nor as valid as the part designed for younger children. His subjects were 81 boys from an institution for delinquents, none with IQ's below 80. Several control groups from various types of environment were matched with the delinquents. In general, the study is well controlled and the statistical treatment is adequate. The chief findings are as follows: (1) somewhat lower mean IQ's on the Goodenough than on the Stanford for the delinquents but not for the control groups, even though chronological ages and home backgrounds were similar, (2) more "incongruities" in the drawings of the delinquents than in those made by the controls, (3) greater juvenility in choice of subjects and more "blood and thunder" characters among the drawings of the delinquents than in those of the controls, and (4) more stereotyped drawings with fewer indications of activity among those made by the delinquents.

When the evidence from these studies is put together, it appears that a Goodenough IQ markedly lower than that earned on the Binet may afford some indication of emotional or nervous instability or, it is just possible, of brain damage. However, inasmuch as the self-correlation of the Goodenough test is not high enough to warrant its use for exact comparisons, a finding of this kind cannot be regarded as more than one of the signs comprised in the total syndrome. If, in addition to the difference between the two test results, there are many incongruities or other unusual features in the drawing, the likelihood of personality disturbance is increased, especially if the Binet test shows the child to be of normal or near-normal intelligence.

New Methods for Studying Child Art. The series of studies carried out by Norman Meier and his students at the State University of Iowa suggests many useful ideas for the study of child art, even though few of them were carried far enough to warrant more than very tentative acceptance of the findings. Of the three monographs, only the first (**195**) deals specifically with the art of children; hence the others will not be considered here. The paper by Daniels (pp. 1–11) describes a method for studying the recognition of compositional balance by children of preschool age. Pairs of block designs, one of which was balanced in composition, the other unbalanced, were constructed within recesses in a wooden frame. The balanced model was sometimes on the right, sometimes on the left. The models were placed before the child, who was given a set of blocks and asked to build a duplicate of whichever one he wished. After he had finished he was told to look at the models again and choose the "nicer" one. Thirty-eight children were subjected to 185 experimental situations. Among the constructions, there were only 18 clear attempts to copy the unbalanced design. In only 31 choice situations were unbalanced compositions preferred. The author states on page 9 that since neither of these proportions is reliably greater than chance, the results indicate that "no child evinced a definite

preference for the unbalanced design." This assertion obviously indicates lack of understanding of the null hypothesis. Jasper (pp. 12–25) made use of four devices for studying rhythm in graphic form: (a) a completion test in which the child was required to select from a number of alternatives the appropriate card to fill a space in a border made up of pictures of concrete objects, (b) a similar test in which abstract forms were substituted for the pictorial elements, (c) a dual choice test in which the two cards were used, one of which contained a rhythmic, the other an arhythmic arrangement of the same seven elements. (d) a construction test similar to that used by Daniels except that rhythm or its lack was the differentiating factor. In all four tests, regular progress with age was observed but other findings were of little significance.

Whorley (pp. 26–45), after a careful analysis of the literature on the subject, decided that the elements of compositional unity upon which authorities seemed best agreed are three in number, viz.: emphasis, balance, and fitness. A test was designed for each. Emphasis was studied by requiring the child subject to arrange four toy trees about a bird-bath. Balance or symmetry was studied by the arrangement of the trees about a central archway. Fitness was evaluated by the arrangement of furniture within a dollhouse. Scale values were obtained by utilizing the median value given by art experts to each of a series of photographed arrangements chosen to represent a roughly graded series. Scores were assigned by comparing the children's arrangements with the photographs as standards. The subjects were one hundred children from three to eight years of age and fifty adults. Little success was attained by the children under four; thereafter improvement occurred, but even among the adults, success, according to the scoring method employed, was far from universal. Whorley reports very high reliability coefficients for the method but inspection of the scatter diagrams shows that these figures are in error by a considerable amount.

Williams (pp. 46–50) has presented a brief report on a method of testing the sensitivity of children to color harmony. A doll-dressing procedure was used. Two identical sets of six small dolls were prepared. Each doll in a set was dressed in different colors. The dolls were handed to the subject one at a time, together with four scarfs of different colors. The child was asked to choose the scarf that he thought "would look nice with the doll's pretty dress." One of the scarfs was of a harmonizing color; the other three were chosen to give as poor an effect as possible. The experiment was repeated, using the second set of dolls. Williams' findings were combined with those of Walton (pp. 51–62), who used the same method with approximately six hundred subjects ranging in age from four years to the adult level. The pattern of change in score with age is curious. Both the mean and the median show a steady *decrease* up to the age of seven, after which improvement continues until the adult level is reached. It would appear that the ideas of color harmony prevalent among young children differ materially from those of the older persons in our culture. It would be interesting to try the same experiment with primitive groups who have had little contact with white civilization. Sex differences were small but consistently in favor of the girls. Only a very slight difference was found between the performance of a small group of children considered by their teachers to be gifted in art and that of another group judged to lack artistic ability. No relationship to measured intelligence was found.

Grippen (pp. 63–81) studied creative imagination in nine children by what she termed the "constant contact" method, which means only that the children

were observed throughout the drawing period and were encouraged, by means of questions and comments, to talk about their work. Four of the subjects were considered talented in art; the other five had shown little interest in it. Apart from the expected differences in the quality of their drawings, the talented children showed more interest in their work; they talked chiefly about their drawings while the untalented were more likely to chatter on irrelevant subjects. Dow (pp. 82–94) found that artistically gifted children were less active on the playground than children with little talent, and that they spent more time playing with materials and less with other children. Rodgers (pp. 95–107) took approximately twenty-five photographs of the interior and exterior features of the homes of each member of two small groups of children considered to be talented in art and for two corresponding groups regarded as untalented. These photographs were projected on a screen and rated by a number of art experts as to the esthetic qualities of the homes depicted. Although for both of the two sets of data compared the advantage lay with the gifted group, the cases were too few and exceptions too many to justify conclusions. The final study in this group is by Tiebout (pp. 108–133). She found that artistically gifted children were superior to the non-gifted on tests of observation and visual memory but not on motor tests. This study, incidentally, is the only one in the series in which the statistical methods appropriate for small samples have been used. The monograph is interesting because of the variety of the problems and the originality of the methods used for their solution, but for the most part the treatment of the data is poor.

The superiority of objective over subjective methods for rating the quality of drawings was demonstrated by Brooks (42), who had thirty drawings of a house and thirty of a boy rated independently by each of twenty-one college students, first on the basis of unaided judgment, then by the use of the Thorndike Scale, and finally by the Kline-Carey Scale. Variability of judgment was only about half as great when a scale was used. The Thorndike gave slightly better results than the Kline-Carey. Similar results were obtained by Lark-Horovitz (156) who lays particular stress on the large number of judges needed for even moderate reliability when the subjective method is used.

"Free" or "spontaneous" drawings are often not so spontaneous as the name implies. In an attempt to find drawings which had certainly been done without direct suggestion from adults, Bender (26) studied a large number of the sidewalk drawings made by children. She was impressed by the many geometrical designs and by the frequent omission of details. The whole rather than the parts seemed to be the dominating principle in making these drawings. Although, as she points out, this observation is in accordance with gestalt psychology, the rough surface of the walk and the coarseness of the medium employed (usually chalk), must also be considered. In a somewhat related study Hurlock (134) collected 1,451 drawings from such unconventional sources as waste baskets, class notebooks, and the like in a number of high schools and colleges. Classification by subjects gave the following results: Decorated words or letters constituted 27.3 per cent of the total; caricatures, 22.8 per cent; human figures, 17.2 per cent. The remainder were divided among more than twenty other classes, with no single topic accounting for more than 8 per cent. Of the human figures well over half were drawings of men; the remainder represented girls or women. Not one of the drawings represented a baby or a child. In view of the

age of the subjects, this is an interesting point.

Both Dallinger (61) and Spielrein (280) have pointed out the relationship between the child's growing awareness of his own body parts and his depiction of these parts in his drawings. Hartenstein (119) and Fontes (95) compared the roles of the literal and the fanciful in children's drawings; the former using German, the latter Portuguese children as subjects. Fontes considered only the proportion of "supernatural" objects such as angels, fairies, the Infant Jesus, etc. The numbers were small at all ages but were many times more frequent among drawings made by girls than among those made by boys. Hartenstein, using a more liberal criterion, found that boys were about twice as likely as girls to depict objects actually seen. She noted also the effect of siblings and associates of similar age upon the character of children's drawings. This she believed to be much greater than that of parents or teachers. She observed that the drawings of girls with brothers but no sisters were likely to be modified in the direction of masculinity and that the converse was true with boys whose only siblings were girls.

Anastasi and Foley (10) found many resemblances to the art of children in the work of non-professional artists who paint merely for their own pleasure. White and Johnson (312) report that children of nursery school age were more successful in interpreting drawings made by their contemporaries than in naming the subjects shown in modern paintings, particularly those of the impressionist school. Many people will not find this surprising!

An experiment by Kröber (150) would bear repetition as a developmental test, using subjects with a wider age-range. Kröber had over four thousand subjects between the ages of thirteen and sixteen years attempt to draw from memory a picture of a formboard into which they had previously fitted eighteen simple geometrical figures—a circle, a square, a star, etc. Half of the subjects made the drawing immediately after fitting the forms in place; the remainder, after a lapse of two hours. No age differences were noted within the range covered, but boys reproduced more figures than girls though the sex difference was not large. The more complex the figure, the more likely it was to be modified in accordance with its expressive value for the subject.

Family resemblances in drawing were studied by Kretschmann (148), who had ten judges attempt to match the drawings of parents and children by a method similar to that of "blind analysis." Success was considerably better than chance. Various cues having to do with similarity of style were reported. Seeman and Saudek (272) studied the handwriting and drawing of three pairs of identical twins. Their major interest was in the handwriting, which is discussed at some length. Specimen drawings are reproduced with little comment but the similarities in style are apparent. It is hardly necessary to point out that both these findings can be accounted for quite as readily by mutual imitation and environmental motivation as upon the assumption of the inheritance of some special talent or behavioral tendency. Meloun (201), in common with several others, found a low positive correlation between skill in drawing and quality of handwriting. This is quite to be expected.

Factor analysis has been applied to scores based on drawing tests or products by Findley (90) and by Koga and Naka (146). The factors identified in both cases appear to involve perception and memory. Neither study discusses a motor performance factor.

The Influence of World War II on Children's Drawings

It has been assumed by many that emotional stress incident to war —the distress due to the breaking up of families and more especially the terror experienced by those directly exposed to conflict—would be mirrored in children's drawings. Perhaps this is the case, but if so, those who have attempted to study the matter have not been sufficiently skilled in the language of child art to read what is there. In most quantitative studies the analysis has been made rather superficially in terms of the percentage of drawings which overtly depict war themes. To the present writers it would seem more reasonable to expect that children genuinely and deeply disturbed by such experiences would be likely to express their feelings covertly rather than overtly, and that only painstaking search would reveal the nature of these signs to an outside observer.

Direct effect of the war upon children's drawings does not appear to be large. Hildreth (**128**) reports an increase from 14 to 22 per cent of war themes in the drawings of kindergarten and primary school children from 1942 to 1943. This may or may not indicate a genuine change, inasmuch as the numbers of children included were small, and boys, who made up a larger proportion of the 1943 than of the 1942 sample, contributed most of the war themes. Naumburg (**224**) presents a descriptive account of the war themes drawn by several children who had been brought to a behavior clinic. She expresses the opinion that the continued drawing of such pictures has a therapeutic value in providing an outlet for suppressed feelings of aggression and in clarifying emotional conflicts. Bender and Wolfson (**31**) describe the nautical drawings of children before and after the outbreak of hostilities. The latter series depicted more detail, especially insignia, and rather more war and combat themes, but the differences are small.

The most complete study of this topic that has come to our attention is by Baumgarten and Tramer (**21**). The subjects were 272 Serbian refugee children who had been evacuated to a camp in Switzerland. Their age-range was from five to twelve years. All had experienced war at first hand. Many had seen their homes destroyed by bombs; a large proportion had lost one or both parents. Nevertheless, when free choice of subjects was allowed, few children elected war themes. Those drawn were for the most part unemotional in character—tanks, soldiers marching, airplanes. More than 90 per cent of the free drawings represented home scenes, flowers, birds, or people engaged in civilian occupations. Quite possibly these drawings are analogous to the "wish-fulfillment" aspect of dreams pointed out by Freud; they represent the

children's desire to forget the painful experiences through which they had recently passed and to experience peace and security once more.

Drawings by the Deaf and by the Blind

Upon the assumption that the elimination of one sensory avenue may give rise to a compensatory superiority in others, a number of persons have examined the drawings of the deaf. Three of these studies have utilized the Draw-a-Man Test, assuming that this test not only may provide more objective evidence of compensatory mechanisms than is given by subjective judgment, but also may constitute a better index of the intellectual level of the deaf than is given by tests of a more verbal character. The three studies agree in finding mean IQ's for the deaf that fall somewhat below the mean for the hearing. The averages are as follows: Peterson and Williams (**243**), 80; Shirley and Goodenough (**275**), 88; Springer (**284**), 96. The first two studies utilized institutional cases. The last included day school children enrolled in special classes for the deaf in New York City, who probably represent a higher socio-economic level, on the average, than children who have been placed in institutions. Thiel (**291**) on the basis of an examination of approximately two thousand drawings made by children in schools for the deaf came to the conclusion that the development of drawing among the deaf parallels that found for the hearing but that progress is slower. Pintner (**246**), using the McAdory Art Appreciation Test, found that deaf subjects between the ages of eleven and twenty-one years performed as well but no better than hearing subjects of corresponding age. Although the deaf girls did slightly better than the boys they showed no superiority over hearing subjects. All this is in direct opposition to earlier studies in which more subjective and possibly more biased methods of evaluation were used.[7]

By far the most important study of the art work of the blind and weak-sighted is found in Lowenfeld's *The Nature of Creative Activity* (**172**), which will be discussed in the section on projective methods. Cook (**59**) has described methods for training the blind in artistic expression. He expresses the belief that many blind are capable of art work of exceptional merit since they are not hampered by a knowledge of the non-essential details that confuse the seeing person. The possibilities of finger painting in treating the emotional problems of the blind have been noted by Napoli and Harris (**221**); a number of case studies show how this procedure can serve as a means of mental catharsis where-

[7] See Goodenough (**105**, p. 276).

by the blind patient may objectify the feelings of resentment and aggression that result from the frustrations due to his condition.

The Drawings of Children in Different Culture-Groups

With the relegation of the theory of recapitulation to the limbo of outworn beliefs, comparisons of the drawings of modern children with those of prehistoric man have well-nigh disappeared from the literature. Prehistoric art is now studied for its own sake and for the light that it can shed upon the culture of the times. A few of the earlier studies in the period covered by this review have discussed the similarities between child art and prehistoric art more or less briefly. Eng's critical discussion (**83**) is enlivened by many excellent reproductions which illustrate the points of similarity very well. Luquet (**175, 177**) has elaborated and extended his earlier work on this topic and Boas (**39**) has included a few notes on the art of modern children in his extensive anthropological report on primitive art.

A number of people, however, have been interested in the art products of the children of primitive groups. From drawings originally collected in 1911 among certain very primitive Indian tribes living in the high plateaus of Bolivia, Rouma (**259**) made a number of interesting observations. He states that the drawings made by adults in these groups were hardly distinguishable from those made by European children under the age of six. The general scheme of the drawings was much the same and they exhibited the same kind of confusions. Many of the Indians had difficulty in orienting the drawing on the paper. "Up" to them meant toward the sky, not toward the top of the sheet. A few of the Indians became interested in drawing and improved with practice, but none advanced beyond the level shown by European children at the age of 12. Du Bois (**71**), in her study of Alorese, reports 99 free drawing performances, including over one thousand figures, of 33 boys and 22 girls, between 6 and 16 years of age. The human figure appears in only 7 per cent of the boys' drawings and in only 1 per cent of the girls'. Plants, animals, and buildings account for 64 per cent of the boys' figures, and plants, tools (including tattoo designs and combs), and buildings make up 84 per cent of the girls' figures. Du Bois remarks that children's drawings, ordinarily made as a play activity, have no relation to Alorese adult art, which is primarily stereotyped and decorative. When specifically asked to portray the human figure, one group of children produced results which were well below the Goodenough age norm, but the drawings of a second group ranked at the standard. The author prefers to speak of differences in "aptitude, adaptation, and the development of skills" (**71**, p. 578) rather than of comparative intelligence. As in other primitive groups, the children showed

no consistent directionality of drawing and no attempt to portray space. Appia (**17**) obtained drawings of the human figure from Negro children in French East Africa. These drawings showed the developmental accretions commonly found in European groups and were quite comparable in general with drawings made by European children of similar age. If anything, the Negro children showed more creative imagination than Europeans. The children drew typically from right to left, a finding not in character with the directionality noted in certain studies discussed elsewhere in this paper. Steggerda (**287**) obtained drawings of a man from 48 full-blood Maya and 330 Maya-Spanish children. Their performance was appreciably below the work of Navaho children and the Goodenough norms, age for age.

Paget (**237**) who studied more than sixty thousand drawings made by children from various parts of Africa, India, China, the South Sea Islands, and elsewhere, does not agree with the view that the difference between the art of primitive children and that of children reared under the influence of Western culture is in the main a matter of *level* rather than *manner* of development. He accepts the two general principles with which most investigators agree, viz.: that children draw not to depict nature but to tell what interests them; and that because they attempt scenes and objects far beyond their technical skill, they are forced to invent their own symbols or devices for indicating them. The second point has been particularly stressed by Fallaize (**88**) and by Naber (**217**). Not all groups adopt the same symbols, but there is a fairly high degree of similarity in those used by any particular group. Paget states (p. 138) that "however they may have arisen, distinctly local modes of representation exist among untaught children and these modes are often peculiar and unconnected with adult tradition." Among these specialized features he noted that 60 to 80 per cent of Maori children begin to draw the human figure in profile between the ages of six to eight years, whereas the average American or European child does not make the shift until around the age of nine. "Mixed profiles" also are rare among the Maoris but are very common among the West Africans. The "hourglass trunk" is also common among several widely separated groups, but is practically never found among others. The nose on the full-face human figure shows the widest variety of symbolizations from group to group. Paget is not inclined to attribute such localized modes of representation to adult teaching or example. He looks upon them rather as traditions handed down from one generation of children to another in much the same way as children's games.

Schubert (**270**) was so impressed by the naturalistic qualities of the drawings of Orotchen children who up to the three months before her study, had never seen a picture or handled a pencil that she was inclined to believe they possessed unusual qualities of eidetic imagery and that the remarkable excellence of their drawings resulted from trac-

ing around the eidetic image as it was projected on the paper. This explanation is questionable, however, since Loch (**170**) and a number of other investigators have shown that the eidetic image can rarely, if ever, be reproduced graphically, even though it can be described with remarkable fidelity.

Of the descriptive studies comparing child art in modern civilized countries, by far the most elaborate is a report by Anastasi and Foley (**8**) on some six hundred drawings from children under the age of twelve. These drawings were displayed at Radio City, New York, in an international exhibition of child art. Forty-two different countries were represented. The study is severely criticized by Spoerl (**283**), who points out that (a) the small number of cases from many of the countries made it difficult to take chronological age into account when comparing the drawings, even though age differences between the child artists were frequently great, (b) mental ages of the children were not known, and (c) many of the differences ascribed by these authors to nationality correspond very closely to the age progression shown in the work of children in this country. An even more serious question not noted by Spoerl arises from the manner in which the drawings were selected. They were chosen by art teachers or art critics in the country of origin, and thus necessarily reflect whatever differences may exist from one country to another in respect to standards of what is good art. By no stretch of the imagination can they be looked upon as representative samples even of the best in child art from the countries in question.

A second study by Anastasi and Foley (**9**) describes the animal drawings of Indian children attending a government school in British Columbia. The authors state that both the subject matter and the technique of the drawings reflect special cultural and experiential factors rather than age differences or developmental trends, although they present few data. Inasmuch as more than half of the subjects were well over twelve years of age, developmental differences would, in any case, be slight, but the age factor should not be overlooked in interpreting this statement. Several illustrations are presented to show the highly stylized patterns used, but the age of the subjects is not stated.

The Draw-a-Man Test has been used in a number of comparative studies of national or racial groups. Manuel and Hughes (**190**) gave this test to two presumably comparable groups of Mexican and non-Mexican children in Texas and found a mean difference in IQ of approximately 10 points in favor of the latter. Eells (**78**) gave both the Draw-a-Man Test and a modified form of the Stanford-Binet to several native groups in Alaska. All groups earned mean IQ's in the low 90's on the drawing; no group averaged above 80 on the Stanford. Although differences are small, the rank-order of the various groups is identical on the two tests. Menzel (**202**) gave the Goodenough test to approximately two thousand school children in East India. The scores earned were

far below those found for other national-racial groups. This was especially true of those earned by girls over the age of ten years—a fact which may be the result of the seclusion of girls as they approach puberty. Datta's (**63**) work with Bengali children revealed age progression, but did not indicate direct comparability with European results. The Draw-a-Man Test has been translated into Chinese by Chang (**55**) and standardized for Chinese children by Hsiao (**132**), with over four thousand elementary school children as subjects. Huang (**133**) is impressed by the similarity of developmental sequences in the drawings of young Chinese children to those found in the work of children of Western cultures, but it would be surprising if there were no differences between the American and Chinese standards for this scale.

In addition to the study by Eells mentioned in a preceding paragraph, the Goodenough scale has been used with at least four groups of American Indians. The first of these, by Telford (**290**), was carried out on a government reservation in North Dakota; the subjects were chiefly Chippewas and Sioux. Both full blood and mixed blood cases were included and the group as a whole earned an average IQ of 88. Telford was chiefly interested in repeating the studies carried out with American Negroes, which have, in most cases, shown a positive correlation between the level of intelligence and the degree of white blood. This was not the case for the Indians, however; as a matter of fact, a small but unreliable tendency in the opposite direction was noted. MacGregor (**184**) reports a study of Sioux in two South Dakota communities. Children in the one with more "white influence" averaged 102 IQ points and the other averaged 113.6. To the geneticist, such findings might indicate that interbreeding between Indians and whites has been carried on chiefly by the less intelligent members of one or both races.

Dennis (**64**) studied Hopi children, a group among whom graphic art has long held an important place. However, it is practiced chiefly by males. He found a marked sex difference in performance on the Draw-a-Man Test. The mean IQ earned by the boys was 117; that earned by the girls was 100. Breakdown of the figures according to age showed a fairly regular tendency for the boys to increase and the girls to decrease in relative standing as age progressed. A similar but more extensive study by Havighurst and his associates (**122**), which involved children from six different Indian tribes, showed a similar sex difference in all tribes where art work is chiefly the responsibility of the males. Russell (**261**), however, found that among Zuni children, culture patterns were less noticeable in the results of the Draw-a-Man Test than in drawings made when free choice of subject was permitted. This, of course, is by no means in opposition to the findings of Dennis and Havighurst. The tests reported by Havighurst are discussed somewhat more extensively in relation to anthropological findings in several

monographs (**138, 160, 184, 292**). The McAdory Art Test was given to Mexican children by Stolz and Manuel (**288**) and to Navaho Indian children by Steggerda (**286**). The Mexican children were also given the Meier Art Test. Both investigators failed to establish any positive relationship whatever between test scores and proficiency in the various arts and crafts practiced by these groups. Vydra (**307**) worked out a series of ratings for judging the artistic merit of drawing. He applied the method to compare the quality of drawings made by the children of different racial stocks in several elementary schools in Slovakia. The rank order was found to be as follows: Slovaks, Hungarians, Germans, Jews, and Gypsies. In America, Merry (**203**) could find no evidence of an unusually large number of artistically gifted children among those of Jewish, Negro, Italian, or "native white" stock. A brief account of the drawings of young children in Soviet Russia has been given by Labunskaya (**151**), who takes the position that child art reflects the social character of the time and circumstances in which it is produced and, as such, is worthy of careful study. He describes a number of different types of research said to be in progress but gives no results.

Developmental changes in the work of Brazilian and Bolivian children when free choice is permitted were studied by Rabello (**251**). As is usual in these studies, variability at all ages was large and there was much overlapping from age to age. The findings do not appear to differ greatly from those of children in other countries. In their study of the free-choice drawings of Serbian refugee children, Baumgarten and Tramer (**21**), however, noted an interesting relationship between the sex of the child artist and the apparent sex of the human figures drawn. At all ages, boys drew chiefly males. Girls under the age of ten drew male figures predominately. Inasmuch as the camp did not admit children over twelve years, the study yields no data on a shift toward a preference for drawing the opposite sex in boys as they approach puberty. As far as we are aware, the point has not been considered by other investigators.

Using Abel's (**1**) method described elsewhere in this article, Taylor (**289**) studied the drawings of young college students in Central India. He found a much smaller percentage of drawings belonging to what Abel termed the "schizophrenic type" than she reported. Of the various castes and religious groups included, Taylor noted that the Hindus and Jains showed less "unity" in their drawings than the other groups. Cultural influences seemed to persist even after several years of common school training which is similar for all sects. However, his numbers are in many cases too small to make the comparisons between subgroups very reliable.

Considering all the evidence thus far described, it is clear that cultural differences do appear to a greater or less extent in the drawings of

children. The present writers would like to express the opinion that the search for a culture-free test, whether of intelligence, artistic ability, personal-social characteristics, or any other measurable trait is illusory, and that the naive assumption that the mere freedom from verbal requirements renders a test equally suitable for all groups is no longer tenable.[8] The studies by Dennis and by Havighurst point the moral very clearly as far as the Draw-a-Man Test is concerned.

There has long been an emphasis upon the need for higher self-correlations and larger correlations with an accepted criterion in a test designed for individual diagnosis than in one intended only for comparisons between groups. We also believe this emphasis has led many psychologists to overlook an equally important principle, viz.; that for valid group comparisons a test must be equally *suitable* for all the groups concerned. The determination of "suitability" is not an easy matter but it cannot safely be ignored. It requires the researcher to set up hypotheses and to test them by carefully conducted experiments. An item analysis will often suggest in what direction sources of cultural bias may lie, for performance on a single item is an easier fact to interpret from this standpoint than is total score on a many-itemed test designed to measure some general and, often, not-too-well defined trait.

We may illustrate our point by a further consideration of the findings for the Goodenough Draw-a-Man Test. Repeated studies have shown that when used with children of reasonably similar cultural backgrounds who are equally motivated to do well, the test is serviceable as a crude measure of "general intelligence," although the moderate self-correlations and correlations with outside criteria make it clear that it cannot serve as a satisfactory substitute for individual tests of the Binet type. From such facts, one might conclude that the test is better suited for ranking individuals than for ranking groups in order of estimated intelligence, provided that the individuals studied are comparatively homogeneous in respect to other factors which affect the results. Thus, the rule that a test of only moderate reliability and validity is better suited to the study of group differences than to the identification of differences among the individuals comprising any group can be accepted only with the reservation that the test is as well suited to the interests and experiences of one group as to those of the others.

[8] The early study by Goodenough (104) which reports the differences in standing on the Draw-a-Man Test by the children of immigrants to the United States from various European countries is certainly no exception to this rule. The writer hereby apologizes for it!

Special Artistic Talent

For valid diagnosis of talent in art, some reasonably objective criterion is obviously needed. A number of the studies mentioned in the preceding sections of this paper have a bearing on this question, particularly those dealing with tests and measurements. In this section we have included only those studies in which the aim was primarily to identify the artistically gifted, rather than to measure the extent of art talent in the generality. A few studies describing the characteristics or background of persons talented in art have also been included. Among the latter, the studies by Grippen (**113**), Dow (**68, 69**), Rodgers (**257**), and Tiebout (**293, 294**), described in an earlier section, should be noted.

Criteria for the identification of the artistically gifted are discussed by Cane (**52**), who describes four characteristics she has found useful: (1) the child's use of his own body (rhythm of movement, posture, etc.); (2) the fertility of his imagination and the quality of his feeling; (3) his ability to organize as shown in his portrayal of form and design, and (4) his "spirit or emanation of life" which necessarily results from the interrelations of the first three. Schmidl-Waehner (**268**) insists that formal criteria such as the size of the drawing, its position on the paper, the types of lines used, and the like are more revealing than content. McCloy's study (**180**) was concerned with the possible effect of lack of manual skill upon manifestations of talent in art. He devised an interesting apparatus in which the subject could achieve various compositional effects by manipulating colored lights directed upon a group of clay figures before a suitable background. As in many such studies, the lack of a suitable criterion for evaluating the results proved to be a major difficulty. Knauber (**144**) studied the art abilities of young children from the nursery school to the third grade and came to the decision that not more than one child in thirteen shows definite talent in art. Subjective judgment, however, was the only criterion used in rating the drawings.

Munro, Lark-Horovitz, and Barnhart (**215**) do not agree with the oft-expressed opinion that the truly gifted in art differ from the generality in possessing special characteristics or combinations of characteristics. According to their studies at the Cleveland Museum of Art, the gifted differ from those with little talent in degree, but not in kind. Age for age, talented children are more advanced in artistic expression. Their development of skill is more rapid and continues long after that of the ordinary child has ceased. They exhibit a stronger interest in visual experience and a correspondingly greater tendency to express themselves in visual terms, even attempting to express non-visual experience by means of graphic symbols. These writers describe a series of experi-

ments and present age norms in terms of which differing levels of talent may, they think, be distinguished.

A number of persons have examined the thesis that artistically gifted persons are more likely than the generality to be morbid, emotionally unstable, eccentric in their habits, or even psychotic. Uniformly, the findings have failed to confirm this belief. Two examples may be cited. Carroll (**53**) evaluated the art ability of older adolescents, using the McAdory and Meier-Seashore tests and quality ratings by experts of art products. He found no relationship whatever to measured introversion, submissiveness, or emotional instability, or to judged general personality disorders. Farnsworth (**89**) had elementary school teachers rate their pupils on a number of carefully defined personality traits as well as for their ability in several types of fine arts including drawing and painting. No relationship whatever was found between rated ability in art and undesirable personality traits. If anything, the reverse tendency was indicated.

Low positive correlations between teachers' ratings on the personality traits of their pupils and ratings on artistic talent have been reported by Flemming (**93**). Cattell (**54**) has developed ratings on 35 qualities, selected to represent the totality of personality. Eight of these correlated significantly (though actual values were low) with artistic drawing ability. Subjects were about 180 young men. Generalizing from the specific findings, Cattell states (p. 140):

> The agreement of this syndrome with the popular stereotype of the earthy, gay, spirited, unstable, careless, Bohemian artist is very striking, yet it must be emphasized that at the time the ratings were made, no one had any idea that the purpose was to correlate them with artistic ability.

His criterion was a judgment by skilled art teachers of the drawing ability shown in work samples by his subjects. The ratings of personality were obtained from an entirely different group of judges. Cattell speculates that a person inherits the appropriate temperamental tendencies; he acquires drawing ability as such on the basis of interests which his temperamental qualities generate.

Case studies of the development and behavior of children who were judged to have marked talent in art or of the early work of those who, as adults, achieved fame as artists, are fairly numerous but few of the reports have much psychological interest. One of the best is by Beck (**23**), who describes the early development of Romano Dazzi and a number of other child artists, together with an analysis of the factors that seemed most influential in turning their attention toward art as a medium of self-expression and self-development. Meier (**197**) has reported the case of a boy, blind from birth, who at the age of seven, was given partial vision by means of an operation. Almost from the beginning, this boy showed exceptional artistic talent, particularly with respect to design and composition and the use of color. In view

of the previous complete absence of visual experience or of special training in art, Meier looks upon this case as affording rather crucial evidence for the essentially innate character of artistic aptitude. In the third volume of his *Studies in the Psychology of Art* (198), Meier lists six factors, all of which he considers essential aspects of artistic ability. These are as follows: manual skill, energy output and perseveration, aesthetic intelligence, perceptual facility, creative imagination, and aesthetic judgment. He adds (p. 158):

> It is the thesis of the writer that the person with these six factors *can* bring this end [extraordinary artistic accomplishment] about and that the person without these *cannot* bring this about to any great degree. The position is, therefore, a deterministic point of view—deterministic in the sense that certain neurophysical and developmental factors seem to be normally a *pre-condition* for the rest of the total development, and that these predisposing conditions are not present equally in all persons, nor, if absent, can they be established. . . . The unique contribution which these fifteen years of investigation have made is the knowledge that all these factors are in a peculiar and unique manner *interlinked*, and the entire dynamic process is a closely knit, interdependent, and evolving process.

Very little seems to have been done in the way of developing objective methods for the study of the interlinkage of factors upon which Meier lays so much stress. In spite of the many who have devoted years of patient research to the problem, the question of the distinction between real artistry and good craftsmanship, if a difference exists, is still unsolved. The main difficulty, as we have said before, appears to be the selection of a criterion. We still ask, with Kipling, "It's pretty, but is it art?"

The Relation of Special Aptitude in Art to General Intelligence

Even before the publication of the Goodenough Draw-a-Man Test in 1926, most of those who had investigated mental development had come to realize that indications of a child's mental level may be observed in his drawings. This fact seems now too well established to require further consideration here. In this section, we shall mention only briefly a few recent studies dealing with the relation between artistic aptitude as such and general intelligence. For the most part, these studies have confirmed earlier findings that both subjective judgments of the artistic merit of drawings and scores on various art aptitude or achievement tests and scales show positive but low correlations with scores on standard tests of intelligence. Studies by Tiebout and Meier (296), Lewerenz (165), and others are examples. The unusually high correlations reported by Bird (37) and by Miller (205) are due to the wide range of ages included in their computations. Had age been controlled, the figures would unquestionably have been much lower.

The fact that a low positive correlation gives leeway for many exceptions to the general rule, some of which may be quite marked, is illustrated by a case reported by Vaughn and Hoose (**301**). A boy of fourteen whose Binet IQ by repeated tests had fallen consistently in the 60's, was found to have exceptional ability in copying drawings both directly and from memory. He also ranked very high on tests of art judgment and art appreciation and on tests of visual imagery. His original drawings also ranked above average in artistic quality. His school records were very poor, both in formal subject matter and in conduct. A change to a program making greater use of his special talent brought about marked improvement along both lines.

Abel and Sill (**2**) made an interesting comparison of normal and feebleminded subjects using a plan similar to some of the experiments of Lewin. Papers on which a 4-in. square had been drawn were given to over four hundred adolescents, who were told to divide it into smaller squares. Children with IQ's above 80 most often utilized cross-sectioning; those with IQ's below 80 were more likely to draw each square separately in a series of "nests."

Hurlock and Thomson (**135**) studied the relation to age and intelligence of seven aspects of drawing. They present the following conclusions: (1) The tendency to perceive the specific rather than the general increases with age; (2) The tendency to perceive background and color placement increases with age and, to some extent, with intelligence; (3) The tendency to perceive associated objects and design increases with age but otherwise shows no relation to intelligence; (4) The tendency to perceive details increases with age and also with intelligence; (5) Accuracy of perception is positively related both to age and to intelligence; (6) Artistic expressiveness as such shows little relationship either to age or to intelligence. These findings are in general agreement with the statement made in the first paragraph of this section, that the correlation between artistic ability and general intelligence is positive but low. In this connection, it may be noted that the estimated childhood IQ's of the famous artists studied by Cox,[9] although much above the generality, were still below the average of most of the other classes of historical geniuses studied. Only the soldiers ranked lower.

Art Education for Children

Inasmuch as most of the studies in this area are of interest to teachers and art supervisors rather than to psychologists, only brief mention of a few of them will be made here. By far the most complete survey of art education is presented in the *Fortieth Yearbook of the National Society for the Study of Education* (**222**). Other reviews of methods used in

[9] Cox, Catharine M. The early mental traits of three hundred geniuses. In L. M. Terman (Ed.), *Genetic Studies of Genius*, Vol. II. Stanford University, Calif.: Stanford Univ. Press, 1926.

the teaching of art have been prepared by Garrison (**99**), Tomlinson (**298**), and Liese (**168**). Some discussion of instructional methods in art also appear in many curriculum studies.

Writers on the developmental aspects of children's drawings have generally expressed the belief that free expression is better than rigid conformity to rules and principles as a method of cultivating art talent. Even greater emphasis on this point is given by those who stress the therapeutic value of child art. This principle has been particularly stressed (though with differing expected outcomes) by Bird (**37**), Dumont (**72**), Foley and Anastasi (**94**), Lowenfeld (**174**), Read (**254**), Schaefer-Simmern (**263**), and Viola (**303**). Kerr (**141**), however, adds that freedom of expression must be cultivated, not left to spontaneity. A somewhat different practice is favored by Todd (**297**), who advocates training children in a "graphic vocabulary" consisting of stereotyped symbols, forms, and figures. Like letters of an alphabet, these forms may be combined in an almost infinite number of different ways in borders, posters, and other forms of decorative design. Powel (**249**) and her associates at the Cleveland Museum of Art, Voss (**305**), and many others stress that acquaintance with the work of great masters as well as instruction in art appreciation has a favorable effect on the art work of children.

Mott (**214**) with children, and Geck (**100**) with college students have shown that adding kinesthetic experience to visual and auditory impressions improves the quality of drawings. Mott had children exercise members of the body as a group "game" before drawing the human figure. Geck emphasized specific tactual as well as kinesthetic experience by having students explore manually a modelled human head before sketching it.

Dubin (**70**), whose experimental and control subjects were carefully paired with respect to age, sex, and intelligence, found that training definitely planned to help children advance from an earlier to a later stage of development in drawing (as these stages have been outlined by psychologists) was more effective than other methods commonly used in schools. Okerbloom (**235**) has presented some data on the effectiveness of Hoyt Sherman's method of teaching art. The essential feature of the method consists in training students to perceive a scene or an object as a whole in which some feature is taken to be predominant with other parts subordinated to the central theme, but nevertheless dynamically related to it.

Drawing as a "Projective Technique." I. Theory and Methods

Many present-day psychologists believe that drawings and paintings as well as play and other forms of spontaneous behavior reveal children's feelings and desires. Such activity, they hold, expresses not

only the needs and emotions dominant at the time, but also the more deep-seated and lasting characteristics known as "personality." Although many earnest attempts to validate this hypothesis have been made, the statistical methods used have frequently been ill-chosen. Moreover, adult associations and concepts have in their turn been projected into the interpretations of the children's "projections" in many instances. This fact provides additional evidence as to the general soundness of projective theory, but it does not induce confidence in the accuracy of the interpretations! In far too many instances, the reasoning has been circular as, for example, when the same group of cases is used to validate a hypothesis as was originally used for formulating it. Nevertheless, flimsy though many of the studies are, the accumulated evidence suggests that the basic concept is sound. Useful and valid signs by means of which dependable conclusions may be reached are, for the most part, still to be ascertained. Many have been reported (Bell [**25**]), but there is little uniformity with respect to their character and reputed meaning. Some agreement in interpretations is to be expected as a result of the common acceptance of certain classes of symbols by child psychologists who have been strongly imbued with psychoanalytic theory. That smearing of colors should be accepted as a sign of anal eroticism, that a preference for red should be thought to indicate feelings of aggression, or that excessive use of dark brown or black should denote depression are assumptions easily understood in terms of common adult associations. As far as children are concerned, however, little evidence is available beyond that of selected case histories. The drawings made by these children may or may not be representative of those made by others whose behavior is similar. Drawings of a like type may be equally common among children who show no indications of the behavior such drawings have been assumed to symbolize. All this has been said many times before, but so much of the work with projective methods has ignored the caution that it seems well to repeat it here.

Of the many studies that have dealt with the art of nursery school children, by far the most elaborate in its conception and presentation is the handsome two-volume report by Alschuler and Hattwick (**4**). Volume II presents the statistics on which the conclusions of Volume I presumably are based, together with more complete biographical data for each child. Here there is evidence of considerable confusion between that which may be true for an individual and that which is characteristic of the group to which he belongs. An example is a case described in Volume I. A little girl designated as Aileen, who was shuttled back and forth between the homes of her divorced parents with

occasional side trips to the home of a grandparent or other relative, repeatedly painted an ovular red mass which she said was a "house." Actually, 133 of the 187 paintings made during her first year in nursery school were of this type. The authors state, without giving figures, that these paintings were more likely to be made during periods when the child was unusually depressed and upset, and that in subsequent years when her paintings had advanced to the pictorial stage, she not infrequently reverted to the old pattern at times when her home life was more than usually unhappy. One would have liked some figures here, yet the following explanation (Vol. I, p. 12) is at least plausible:

> It is not difficult to understand Aileen's unhappiness and her constant anxiety about "home". . . . In her persistent painting of the ovular red mass, as the full data substantiate, Aileen was expressing her need and deep craving for a home which would give her adequate protection and love.

The present writers are inclined to think that in view of the very large amount of material available for each one of the 150 children, the authors might have done better to have used statistical methods which have been worked out for the study of the individual case, together with some interchild comparisons, without attempting to pool the findings in the manner described in Volume II. The latter method may, in fact, be misleading. There is no good reason to suppose that the symbolic language of children is universal; it may well differ from one child to another. If this is true, then the only generalizations possible are in terms of principles, not of specific symbols. The criticisms of Harris (118), Anderson (15), and others with respect to the discrepancies between the interpretative material and the quantitative evidence of this study are assuredly warranted. Nevertheless, the material gathered should be of much value if the sympathetic insight of the authors were supplemented by a greater degree of statistical acumen.

Appel (16) describes an interesting method of utilizing drawing as an aid to securing free verbal expression from a child in the course of a psychiatric interview. The procedure, which is presented in detail, involves alternate drawing by child and psychiatrist with gradual approach to the more intimate details of home life about which children are often unwilling to speak freely. England (87) has studied parental identification in children by means of childlike stick figures. Schliebe (267) was interested in determining how children depict states of feeling in their drawings. Six drawings were secured from each of 478 children between the ages of four and eighteen years. First they were told to draw a tree. This was used as the standard with which other drawings were to be compared. The children were then told to draw a cold tree, a happy tree, a frightened tree, a sad tree, and a dying tree. Comparisons were made in terms of height and width, the direction in which the branches typically pointed, and a number of other features. The chil-

dren were then asked their reasons for making the kind of drawings they did. Recall or imagination of their own kinesthetic sensations under similar conditions was the typical reason given.

The child's concept of the self is commanding more attention in the literature of recent years. The significance of drawing for the self-concept has been discussed by Dallinger (61) and by Wolff (321). Wolff, like Appel, suggests that the child's drawing of his family may show how he feels about his psychological status in that group. Machover's (189) fairly elaborate theory is based on the hypothesis that the self is projected into drawings of the human figure and that interpretation can be based on direct analogy. Brown and Goitein (43) believe that a subject's self portrait, drawn while blindfolded, will reveal in the distortions certain characteristic personality "needs." Spielrein (280), Wolff (319), and Mira (206) have also noted the clinical significance of drawings made without visual inspection of the results.

Bühler (47) has used the familiar Ball and Field Test from the Stanford-Binet to study the effect of emotional disturbances. Wechsler and Hartogs (311) have used mirror drawing for a similar purpose. The Bender-Gestalt Test (28) already mentioned has been widely used clinically, but has not been much discussed in the literature, although Billingslea (36) has reported an attempt at "standardization." Harms (116) has proposed three methods which he considers likely to prove useful in the study of neurotic children: (1) single lines drawn to denote words having affective value (a method later reported more fully), (2) drawing a picture to illustrate any word of his choice from a list of strongly affective terms, and (3) the "face" test, in which the child is asked to make one picture illustrating the thing he likes best and another illustrating the thing he most strongly dislikes. These devices are not offered as finished products but as suggestions that have appeared promising in a number of preliminary cases of which examples are given. England (86) asked a group of ten- to fourteen-year-old children to "draw the most important event in your life." Twenty-seven per cent of all the drawings were of fears, and the great majority of drawings of fear situations reflected traumatic episodes. On the basis of this, England is inclined to the notion that fears among older children are preponderantly concrete and based on trauma. Most child psychology textbook writers tend to hold that fears in older children are principally imaginative and based on associative learning. He does not question the difficulty or ease with which different kinds of complex events could be depicted. Williams (315), who was also interested in questions of methodology, found that drawings made by maladjusted children when alone in a room without distracting influences are more revealing than those made in the presence of the examiner. However, this finding should be checked; it may vary with the interpersonal relations of

examiner and child. Most clinical psychologists hold that the drawing behavior itself must be observed.

Zilahi-Beke (**328**) made use of the works of Michelangelo to show how childhood experiences may influence the character of the art work of an adult. He explains the gigantic size of the figure of the young David (with whom the artist presumably identifies himself) on the basis of Michelangelo's jealousy and resentment of the favored position of his older brother. Shock and grief at the loss of his mother at the age of six is suggested as an explanation for the loving care with which he depicted the figure of the Virgin in the Pieta group as well as for her very youthful appearance, which would correspond to his memories of his own mother at the time of her death. These speculations are interesting and, to some extent, plausible, but there is, of course, no way to verify them.

On the basis of a critical study of the drawings of eight children, four of whom were popular with their playmates and four unpopular, Elkisch (**80**) developed a method of scoring by which a child's social qualities might be diagnosed. Following are the criteria used: rhythm vs. rule; complexity vs. simplexity; expansion vs. compression; and integration vs. distintegration. Examples and definitions of each type are given. Until the scale has been given more extensive trial, little can be said about its usefulness, particularly since no outside validation was attempted by the author. In a second article (**81**), Elkisch reiterates her position that a single drawing is insufficient evidence for sound diagnosis and that form rather than content should be the basis for judgment. This latter view, that formal elements are more significant for personality than meanings *per se*, is reminiscent of the Rorschach. Unlike many others of the psychoanalytically inclined who favor "meanings," Schilder and Levine (**266**) apply Freudian symbolism to the formal elements of line, color, angles, borders, contours, balance, and the like, rather than to interpretations of content.

A similar emphasis on formal "scoring elements" appears in Waehner's study (**308**), in which students were asked to draw human faces and figures of specified types. Her scoring sheet suggests the Rorschach even more strongly than the scheme of Elkisch. The statistical treatment is crude but as far as the data go, they suggest that the method has some value in differentiating personality types. Munroe, Levinson, and Waehner (**216**) with college students as subjects found that the Waehner system of interpreting drawings predicted standing on the Rorschach with a degree of accuracy that exceeded the one per cent level of confidence (chi-square method). Pfister (**244**) used color and movement in crayon drawings as diagnostic elements.

Buck offers the H-T-P Test (**45, 46**), which requires the subject to draw a picture of a house, a tree, and a person after which he responds to questions concerning the factors determining the character of his drawings. The method is discussed by Landisburg (**152**), together

with an account of six cases and samples of their drawings. Buck's monograph (**46**) supplies detailed definitions of scoring categories and rules for scoring. Thus, a basis for quantitative study is afforded. Unfortunately, Buck's own statistical criteria for denoting certain characteristics as unusual, while consistently applied, appear to have no basis in statistical logic (e.g., satisfying a particular level of significance). In Buck's monograph an appendix by Payne makes some suggestions concerning the use of color.

A more abstract approach to the problem is described by Harms (**117**). Approximately ten thousand subjects ranging in age from the kindergarten to the adult level were asked to draw lines representing certain words, chiefly verbs and adjectives such as "walking," "cry," "silent," etc. His immediate task was to reduce the material to a series of objectively defined types which could be used as a basis for further work. Six forms were eventually delimited: (1) *monographical*, (2) *cursive*, in which the same figure was repeated several times in a running line, (3) *pictographical*, (4) *script*, in which a long line was drawn with undulations or circles such as to suggest writing, (5) *spatial*, in which the subject attempted to convey the quality by a change in the direction or form of the line, and (6) *final*, in which the only guiding principle seemed to be that of bringing the line to an end. Whether or not the method may prove useful in the actual differentiation of personality types remains to be seen, but the study is one of the most carefully worked out in the field. Using a very similar method, Krauss (**147**) found that when lines drawn by one set of students to depict various emotional states were shown to a second group, correct identification was made in 72.5 per cent of the cases.

Perhaps the most daring of the methods proposed for the analysis of child personality by means of drawing is that given by Wolff (**321**) in the Table of Graphic Elements on pages 223–226 of his *Personality of the Preschool Child*. Although the table is preceded by a few precautionary remarks, the list is presented as if it were wholly factual. Unfortunately, it is likely that these cautions will be unheeded by the enthusiasts and the scientifically unsophisticated who may be impressed by the plausibility of the argument. Some seventy characteristics of children's drawings are arranged in columns with the personality attribute supposedly indicated thereby placed in a parallel column. Examples are:

> Preference for circular movements—Balance, changing moods, evading any decision, manic-depressive
>
> Preference for shadings—Tactile sensitivity
>
> Interruptions in strokes—Stubbornness, negativism

It is to be noted that most of the drawing characteristics named represent continuous rather than discrete variables, though they are not so indicated here. Apart from descriptive accounts of individual cases,

objective evidence for the validity of these relationships is wholly wanting. Wolff promises a detailed description of the scoring and analytic method, together with research evidence in a later volume on drawing and handwriting (**322**). From our viewpoint, it is regrettable that this later volume, although presenting some ingenious hypotheses on the projective character of handwriting, contains only a brief mention of drawing. Actually, it refers back to the earlier text for the detailed discussion and data! This illustration is presented to indicate the all too frequent state of affairs in the work with projective techniques. Ingenious hunches and anecdotal "evidence" appear, but not painstaking objective analysis conducted with sufficient cases, or repeated samples.

Napoli (**219**) has been rather more cautious in his conclusions. He describes points to be observed which he thinks may prove useful for diagnostic purposes, but does not ascribe hard and fast meanings to them.

Brick's analysis (**40**) of the significance of color preferences shown in the drawings and paintings of children seems likewise to be more dependent upon intuition than upon facts. The same can be said of Machover's interpretation (**189**) of the human figure drawings of her subjects. Further discussions of the projective theory as applied to child art have been given by Tomlinson (**299**), Bruen (**44**), Kienzle (**142**), and others. A brief note by Green (**110**) on the response of a boy of three years to the first question known to have been put to him concerning the meaning of his scribbles on his toy blackboard holds some theoretical interest. Pointing to the drawing, his father asked, "What is that?" The child hesitated a moment and then replied, "It's a thinking."

Upon the assumption that in the art products of the blind, from whom the visual appearance of the external world is largely or wholly hidden, some insight into the nature of creative experience may be had, Lowenfeld (**172**) studied a large number of the drawings, paintings, and clay models made by blind and partially sighted children and adults. He questioned them about their mental processes while drawing, and inquired into the reasons determining their manner of drawing. From his studies he concludes that there are two sources of experience, leading to two types of creative expression. The first has its origin in visual or other types of perception and in the aesthetic pleasure directly experienced thereby; the artist attempts to reproduce the object as it appears and thus convey a similar pleasure to others. This type of art work Lowenfeld designates as the optic or visual type. The other type of experience is personal. It consists of the feelings and emotions aroused by the total situation; the artist primarily attempts to convey these feelings in his work. In Lowenfeld's terminology, such products are classed as "haptic." They differ from the type previously described in their lessened fidelity to objective reality and their greater fidelity to some definite core of meaning. This meaning is frequently, though

not always, discernible to an outsider. There is a centralization of attention upon those features that convey the meaning, with corresponding neglect of other parts that are equally open to visual perception. Lowenfeld's discussion of these factors and his exposition of them in the many remarkably fine color prints contained in the Appendix is highly stimulating and should be read by all who are interested either in projective theory or in the psychology of art. Wiggin (**313**) in a paper not yet published has developed a combination of a test based on drawings and a rating scale, which together are designed to distinguish between the two types of graphic expression. Quantitative data on this test are insufficient to determine its usefulness. In a more recent book (**174**), which is designed as a textbook for teachers, Lowenfeld has placed more emphasis upon the developmental aspects of drawing together with notes on the possible significance of color, line, and form at the various stages. Like the preceding book, the volume is profusely illustrated.

Thus, the evidence accumulates that children's drawings provide significant cues for personality diagnosis. Thus far, however, no completely developed characterological system based on this evidence has appeared. Wartegg (**309, 310**) offers the only characterology based on drawings which has come to our attention. Like many of the German characterological systems developed during the thirties, it is politically oriented. Alschuler and Hattwick, and Wolff come closest to it in this country, though the thinking of Buck and of Machover have possibilities of enlargement into complete theories, in which a psychology of drawing is integrated with a psychology of personality. All this material needs more extensive validation.

Drawing as a "Projective Technique." II. Clinical Use with Maladjusted Children and Adolescents

Many have expressed the belief that disturbed or maladjusted children may reveal signs in their drawings from which the nature and causes of their difficulties can be inferred. Zachry (**325**), Levy (**163**), Sigg-Boeddinghaus (**276**), Oberlin (**234**), and Dunnett (**73**) may be particularly mentioned for their clear discussions of the principles involved, although they present little or no new material.

Questions of methodology have interested a number of persons. For the most part, their material has been discussed in the preceding section except for a small number of papers which deal specifically with the question of diagnosing maladjustment. Drawing as a therapeutic treatment for maladjusted children has been discussed in several studies. In general, the theory assumes that the drawing serves as a form of mental catharsis whereby the child works out his difficulties. The

leading exponent of this point of view is Naumburg (**223**, **224**, **225**, **226**, **227**, **228**, **229**), who has set forth her theories very lucidly and illustrated them by means of a series of detailed case studies. Several of these articles were later republished in monograph form (**230**). In each of the case studies, she has described in detail the stages in drawing by means of which the disturbed children exhibited their progress toward recovery. These stages differed from child to child according to his level of maturity and the nature of his problem but, in spite of occasional regressions to an earlier stage, Naumburg believes that progress can be observed readily by one who is skilled in reading the signs. A single example will suffice. A nine-year-old boy showing many indications of nervous and emotional disturbances on first entering the clinic was interested mainly in copying landscapes of a relatively peaceful character. Later, as his repressed feelings were brought to light, he began to prefer scenes showing volcanos in eruption, storms at sea, and the like. He then began to make original drawings of ghosts, devils, and skeletons, which were drawn with much attention to detail. At this stage, his drawing was frequently accompanied by profane or obscene remarks. He then began to draw fire scenes. At this time, his hostility toward his foster parents was openly expressed. Thereafter, he began to delight in drawing circus themes and roles in which his improved ego development could readily be observed. Naumburg states that at all times, his drawings and the remarks which accompanied them showed a clear distinction between the real and the imaginary. This was an important point in eliminating the diagnosis of schizophrenia. Bender (**27**) stresses the value of art work as a diagnostic and therapeutic medium for children who find it difficult to express themselves verbally. McIntosh and Pickford (**188**) have given a fairly detailed report of a single case in which drawing was found to have a definite therapeutic value. Less complete information about several other cases is included. Reports of single cases have also been given by Merzbach (**204**) and by Edelston (**77**).

The use of drawing as a means of establishing rapport between child and psychiatrist has been noted by several writers, among them Freeman (**98**) and Appel, whose work has already been mentioned. Arlow and Kadis (**18**) take the same view with respect to finger painting. In all of the younger children described by Witmer and her associates (**318**), drawing was found to be an important means to that end. Its use for diagnostic and therapeutic purposes is also noted in a number of the cases.

McIntosh (**187**) takes the position that drawing may be looked upon as a form of psychoanalysis and presents a number of interesting case reports in support of her thesis. Bender and Rapoport (**30**) divided the animal drawings of children into two broad categories, aggressive and non-aggressive, with several sub-categories under each head. Their zeal

for finding relationships was hampered by the small number of cases studied (only seventy-five in all), in view of which their conclusions are questionable, though the procedure is suggestive. Phillips and Stromberg (**245**) studied the finger-paintings of twenty-five carefully matched pairs of subjects. One member of each pair was taken from a detention home for delinquents; the other from a nearby high school. Paintings were scored on the basis of predominating color, area of painting, choice of subject, and a number of similar characteristics. Differences between the delinquents and the controls reaching or exceeding the 5 per cent level of confidence were found for fourteen of the seventeen categories considered. The authors are properly cautious in drawing conclusions from these findings, for, as they point out, factors not considered in the matching may have been chiefly responsible for the differences found.

Lembke (**161**) compared the drawings of seventeen pairs of children selected by their teachers as being the boldest and the shyest in their classes. Although the small number of cases render generalizations hazardous, it is interesting to note that the differences which appeared run contrary to what might be expected on the basis of surface reasoning. The shy children used brighter colors than the bold, and showed a definite preference for complementary colors. The bold children used darker colors—in several cases a combination of violet and dark brown. In another small group of cases, Traube (**300**) found the use of violet and brown to be indicative of "depression." Alschuler and Hattwick (**4**) note a developmental shift in color preference, younger children preferring warmer colors (red, yellow), older children preferring cooler colors (blue, green). They maintain that among children of a given age, the less well adjusted and more immature will prefer the warmer colors, and the more over-controlled, "grown-up," well-behaved children will use the cooler colors. Ruesch and Finesinger (**260**) related the Rorschach color response to the use of color in paintings. The feeble-minded cases used more red in the drawings than normals, but gave no red differential in Rorschach responses. Introverts preferred gray in painting. Obviously, there is little agreement among these findings. The significance of color preference has long been a matter for conjecture and belief; its diagnostic value needs more complete verification.

England's (**85**) comparison of the drawings of "middle class" normal, mentally retarded, neglected, and delinquent children seems to have yielded few differential results, a fact that may perhaps be ascribed to his failure to control even such obvious matters as age and sex.

Vogelsang (**304**) classified the art products of boys in a correctional institution, according to the themes depicted. "Erotic" drawings made up 43 per cent of the total; adventure, 9.6 per cent; caricatures, 8 per cent; autobiographic fantasy, 6.6 per cent; figurative drawings including animals, landscapes, abstract designs, etc., 32.6 per cent. The longer

had been the period of incarceration, the greater the number of art products made—a fact which suggests that such work, like the day-dream, afforded a means of escape from the accumulating unpleasantness of their institutional life.

Drawing as a "Projective Technique." III. The Art Products of Psychotic Children and Adolescents

Inasmuch as true psychotic states are rare before the latter part of the adolescent period, the literature on the drawings of psychotic children is scanty. The four reviews by Anastasi and Foley on the artistic behavior of the abnormal (**11, 12, 13, 14**), cover the field up to about 1940, but, as would be expected, their reports deal mainly with the work of adults. We have checked their bibliographies against ours and have eliminated all duplications except those dealing with the art of children and a small number of others in which significant comments or comparisons with child art are made. We have not attempted to cover the fairly large body of literature on the art of abnormal adults since the Anastasi and Foley reviews except in a few instances of the type just mentioned. For example, we have listed Fleming's article (**92**) on the use of finger painting in mental hospitals because of the popularity of the method as a projective device for use with children. Mohr (**208**) has stressed the significance of the strange and unusual features so often found in the drawings of the mentally ill and has pointed out that while patients rarely depict their hallucinations overtly, they do so covertly by means of these peculiar symbols that are incomprehensible to anyone but themselves. This is as true of children as of adults.

Occasionally the drawings of a child resemble closely those of a schizophrenic patient. Cameron (**51**) ascribes this resemblance to the failure of the usual mechanisms whereby the drawing serves a form of social communication. It thus takes on forms that are peculiar to the individual as is true in the cases of those made by the schizophrenic.

Fingert, Kagan, and Schilder (**91**) used the Draw-a-Man Test as a means of measuring improvement in schizophrenic patients following insulin or metrazol shock. Although forty cases were studied, only the detailed results for several individual subjects said to be typical are reported. A steady improvement in score during the period of recovery from shock is apparent in all these cases. It is unfortunate that no control drawing seems to have been secured previous to the administration of the shock. Schilder and Levine (**266**) trace the relationship between drawing and psychic disturbance to the basic motor drives of the individual which, in the seriously disturbed, modify his handling of the abstract principles of drawing—curves, angles, straight lines, balance, and the like.

Abel (1) asked several groups of institutionalized patients to produce a design within a 4 in. by 6 in. rectangle by the use of exactly 19 straight and 6 curved lines. She found that schizophrenics were particularly concerned about getting in the exact number of lines, but were typically unable to make a balanced design; their drawings were unorganized. This lack of organization was especially marked in paranoids and to a less degree in subjects classed as "normal, showing paranoid trends."

There are a few published case studies of the drawing behavior of individual children and adolescents tentatively diagnosed as psychopaths or at least as extreme neurotics. Naumburg (223) has given an account of the drawings of an adolescent girl suffering from anxiety hysteria with amnesia. The factors giving rise to her complaint were revealed in her drawings before she was able to express them verbally. Merzbach (204) has described the work of a thirteen-year-old boy during a temporary psychotic state in which he felt impelled to express himself by drawing. Analysis and discussion of the drawings showed the boy to be suffering from intense anxiety, but, Merzbach felt, definitely exclude the diagnosis of schizophrenia. It is quite possible that some of the unusual cases described in other reports were in reality exhibiting the early stages of a psychosis not yet diagnosed as such.

Bender's report on the use of the Goodenough test among children suffering from chronic encephalitis has already been mentioned. This test was also used by Berrien (33) in a comparison of the drawings of three groups of abnormal children including 24 post-encephalitics, 13 diagnosed as having "psychopathic personality," and 15 borderline mental defectives. The Binet test, apparently, was not given. The post-encephalitic cases showed a number of the characteristics noted by Goodenough as possible indicators of neurotic or psychotic states; most notably reversal of sex characteristics and combinations of mature and primitive characteristics in the same drawing. An item analysis was also attempted, but the number of cases was too few and the spread of ages too great to lend much value to this part of the study. Chase (56) found that among the schizophrenic groups she studied, the hebephrenics ranked lower than the paranoids on the Goodenough test and that both were inferior to normal subjects of similar age and education.

It may be noted that most of the reports on the art of the abnormal have to do with the schizophrenic group. However, particularly in the case of children, studies of those suffering from some form of brain damage caused either by accident or disease are coming to occupy a fairly important place in the literature (see p. 377, this paper). The reason for the large number of reports based upon schizophrenic patients is two-fold. In the first place, as Kris (149) and others have shown, a greater number of these patients are interested in drawing or other forms of artistic activity. In the second place, their drawings seem to be more distinctive in type, more clearly set off from those of normals, than are those of other clinical groups. For many schizo-

phrenics, art becomes a means of covert self-expression. By means of seemingly inappropriate and senseless symbols, the meanings of which are known only to himself, the patient gives vent to his troubles, communicates his feelings to the insensate paper, and in so doing finds a measure of relief. From the standpoint of this survey, too, the drawings of the schizophrenic are of special interest, since this is the only form of functional mental disease that occurs in numbers great enough to be appreciable during the years of later childhood and adolescence.

More dynamic theories of personality in recent years have reinstated to some extent the belief that personality forces may undergo considerable realignment as a person departs more and more from his usual habits of perception and judgment, that somewhere along the behavioral continuum from the normal to the abnormal a fairly sudden reorganization of the personality occurs. One gets this impression from a consideration of the art of seriously disturbed or psychotic subjects. Bizarre features appear; the total effect of pictures by such patients is quite different. The process by which a severe neurosis or a psychosis develops has not, to our knowledge, been studied in a suitable collection of drawings. But the process, as this review points out, has been studied in reverse. As the patient improves, rather sudden and dramatic shifts in content and technique of drawings have been observed. This possibility leads us to question whether interpretive principles suitable for study of the art work of clinic patients can be applied directly in the personality analysis of well-adjusted children. Brown and Goitein (**43**), for example, conclude from studies of psychotic subjects that when a normal person's drawing fits a particular abnormal category, his personality will show trends intermediate between the normal and the not-normal which fit that psychiatric group.

Even though the continuity exists, the variance in "normal" expressions of abnormal deviations may be so slight as to defy our present methods of observation. It may be that "signs" of behavior as contrasted with samples of skills[10] are best considered as attributes rather than as variables, or that they must be judged more ideographically than nomothetically. Such possibilities, at least, may indicate why attempts to validate observations in the clinic by discovering an analogous though smaller variance among normal subjects have proved disappointing.

Conclusions

In the course of the twenty years since the last report on this sub-

[10] Goodenough, Florence L. The appraisal of child personality. *Psychol. Rev.*, 1949, **56**, 123–131.

ject appeared in the *Bulletin*, interest in the psychological aspects of children's drawings has continued to be strong but its direction has been somewhat modified. Chiefly, this change may be attributed to the recent upsurge of interest in projective theory and method. Although both the psychological use of the term "projection" and its underlying concepts had been well known since the early writings of Freud, and although a number of well-known "projective" tests were developed previous to 1939, the recognition that methods of this type are based on a different psychological theory from those of the more conventional type, waited for Frank's definition in 1939.[11] As is not infrequently the case, the immediate result of classifying and naming was a marked upswing of interest in these procedures. Although reference to the bibliography will show that the practical use of children's drawings as a projective device began long before Frank's article was written, the underlying theory upon which these earlier studies were based was rarely stated explicitly.

Other changes in the types of studies that have appeared since the publication of the earlier article may be noted. Interest in the developmental aspects of children's drawing has shifted from the broad outline to more specific details of form and line, composition, design, and the use of various media, such as clay or finger painting. There has been far more concern than formerly over questions of methodology, particularly among those whose primary interest is in the field of tests and measurements. It is unfortunate that this concern has not been shared by the majority of those interested in projective methods.

The possibility of utilizing children's drawings as aids to the solution of problems in general psychology has also been more clearly realized. For obvious reasons, visual perception and visual memory have been the areas most frequently studied by drawings, but the ramifications of these topics are many. The relationship between perception and the characteristics of the perceiving individual is a fascinating topic, of which only exploratory studies have been made. Finally, the large body of literature on the art of the abnormal leads directly to the art of childhood, for the psychotic adult was once a child who, in all likelihood, drew pictures. Whether or not these pictures differed in any determinable way from those drawn by children who were destined to lead more normal lives is unknown, but the possibility is worth investigating. Actual drawings, if preserved, are free from the halo effect that is likely to be found in verbal reports by persons whose memories of

[11] Frank, L. K. Projective methods for the study of personality. *J. Psychol.*, 1939, 8, 339–418.

the patient's early behavior may be influenced by a knowledge of his later difficulties.

Study of the art of children is now well past the stage at which a useful purpose can be served by simple tabulations of subjects drawn by miscellaneous groups of children, or the reiterations of developmental sequences that were worked out a quarter of a century ago. The urgent need at the present time is a series of objectively defined and reliably measurable categories which may be used for the testing of hypotheses and the determination of relationships. The existence of such measures would by no means free the research worker or the clinician from a need for the type of insight that can be gained only from intelligent experience. Such categories, however, would enable him to design his experiments in such manner that the validity of his claims could be more readily judged by others. A variety of measures suitable for many different purposes in the fields of experimental and clinical psychology would be desirable, for the art of children and youth may be considered from many different aspects, and drawings vary widely from one experimental set-up to another. The field is wide and the way is open.

BIBLIOGRAPHY

1. ABEL, THEODORA M. Free designs of limited scope as a personality index. *Character & Pers.*, 1938, **7**, 50–62.
2. ABEL, THEODORA M., & SILL, JANE B. The perceiving and thinking of normal and subnormal adolescents and children on a simple drawing task. *J. genet. Psychol.*, 1939, **54**, 391–402.
3. ALSCHULER, ROSE H., & HATTWICK, LA BERTA W. Easel painting as an index of personality in preschool children. *Amer. J. Orthopsychiat.*, 1943, **13**, 616–625.
4. ALSCHULER, ROSE H., & HATTWICK, LA BERTA W. *Painting and personality, a study of young children.* Chicago: Univ. of Chicago Press, 1947. Two vol.
5. ALSCHULER, ROSE H., & HATTWICK, LA BERTA W. Understanding children through their paintings. *Understanding the Child*, 1947, **16**, 98–101.
6. AMES, LOUISE B. The Gesell Incomplete Man Test as a differential indicator of average and superior behavior in preschool children. *J. genet. Psychol.*, 1943, **62**, 217–274.
7. AMES, LOUISE B. Free drawing and completion drawing: a comparative study of preschool children. *J. genet. Psychol.*, 1945, **66**, 161–165.
8. ANASTASI, ANNE, & FOLEY, J. P., JR. An analysis of spontaneous drawings by children in different cultures. *J. appl. Psychol.*, 1936, **20**, 689–726.
9. ANASTASI, ANNE, & FOLEY, J. P., JR. A study of animal drawings by Indian children of the North Pacific Coast. *J. soc. Psychol.*, 1938, **9**, 363–374.
10. ANASTASI, ANNE, & FOLEY, J. P., JR. The study of "populistic painters" as an approach to the psychology of art. *J. soc. Psychol.*, 1940, **11**, 353–368.
11. ANASTASI, ANNE, & FOLEY, J. P., JR.

A survey of the literature on artistic behavior in the abnormal. I. Historical and theoretical background. *J. gen. Psychol.*, 1941, **25**, 111–142.

12. ANASTASI, ANNE, & FOLEY, J. P., JR. A survey of the literature on artistic behavior in the abnormal. II. Approaches and interrelationships. *Ann. N. Y. Acad. Sci.*, 1941, **42**, 1–111.
13. ANASTASI, ANNE, & FOLEY, J. P., JR. A survey of the literature on artistic behavior in the abnormal. III. Spontaneous productions. *Psychol. Monogr.*, 1940, **52**, No. 6, 71 pp.
14. ANASTASI, ANNE, & FOLEY, J. P., JR. A survey of the literature on artistic behavior in the abnormal. IV. Experimental investigations. *J. gen. Psychol.*, 1941, **25**, 187–237.
15. ANDERSON, J. E. Personality organization in children. *Amer. Psychologist*, 1948, **3**, 409–416.
16. APPEL, K. E. Drawings by children as aids to personality studies. *Amer. J. Orthopsychiat.*, 1931, **1**, 129–144.
17. APPIA, B. La représentation humaine dans les dessins d'enfants noires. (The human being in drawings by Negro children.) *Bull. Inst. franç. Afrique noir*, 1939, **1**. (*Psychol. Abstr.*, 1946, **20**, No. 3341.)
18. ARLOW, J. A., & KADIS, ASJA. Finger painting in the psychotherapy of children. *Amer. J. Orthopsychiat.*, 1946, **16**, 134–146.
19. BARNHART, E. N. Developmental stages in compositional construction in children's drawings. *J. exp. Educ.*, 1942, **11**, 156–184.
20. BAUMGARTEN, FRANZISKA. Supranormales Zeichnen eines Kindes. (Supernormal drawing of a child.) *Z. Kinderpsychiat.*, 1936, **2**, 182–189.
21. BAUMGARTEN, FRANZISKA, & TRAMER, M. Kinderzeichnungen in vergleichend psychologischer Beleuchtung. (Child drawings in the light of comparative psychological study.) *Z. Kinderpsychiat.*, 1943, **9**, 161–220.
22. BEACH, VERA, & BRESSLER, MARY. Organizing a painting set-up for young children. *J. exp. Educ.*, 1944, **13**, 77–80.
23. BECK, O. W. *Self-development in drawing as interpreted by the genius of Romano Dazzi and other children.* New York, London: G. P. Putnam's Sons, 1928.
24. BELART, W. Die sinnespsychologischen Grundlagen seiten- und hohenverkehrter Kinderzeichnungen. (The sensory basis of lateral and vertical inversions in children's drawings.) *Z. Kinderpsychiat.*, 1943, **10**, 8–13.
25. BELL, J. E. *Projective techniques; a dynamic approach to the study of personality.* New York: Longmans, Green and Co., 1948.
26. BENDER, LAURETTA. Gestalt principles in the sidewalk drawings and games of children. *J. genet. Psychol.*, 1932, **41**, 192–210.
27. BENDER, LAURETTA. Art and therapy in the mental disturbances of children. *J. nerv. ment. Dis.*, 1937, **86**, 249–263.
28. BENDER, LAURETTA. *A visual motor gestalt test and its clinical use.* Research Monographs, No. 3. New York: American Orthopsychiatric Assn., 1938.
29. BENDER, LAURETTA. The Good-enough test (drawing a man) in chronic encephalitis in children. *J. nerv. ment. Dis.*, 1940, **91**, 277–286.
30. BENDER, LAURETTA, & RAPOPORT, J. Animal drawings of children. *Amer. J. Orthopsychiat.*, 1944, **14**, 521–527.
31. BENDER, LAURETTA, & WOLFSON,

W. Q. The nautical theme in the art and fantasy of children. *Amer. J. Orthopsychiat.*, 1943, **13**, 462–467.

32. BERDIE, RALPH F. Measurement of adult intelligence by drawings. *J. clin. Psychol.*, 1945, **1**, 288–295.
33. BERRIEN, F. K. A study of the drawings of abnormal children. *J. educ. Psychol.*, 1935, **26**, 143–150.
34. BIBER, BARBARA. *Children's drawings: from lines to pictures.* New York, Bureau of Educational Experiments, Cooperating School Pamphlet No. 6, 1934.
35. BILLING, MARION L. A report of a case of inverted writing and drawing. *Child Develpm.*, 1935, **6**, 161–163.
36. BILLINGSLEA, F. Y. The Bender-Gestalt: an objective scoring method and validating data. *J. clin. Psychol.*, 1948, **4**, 1–27.
37. BIRD, M. H. *A study in aesthetics.* Harvard Monographs in Education, No. 11, Cambridge: Harvard University Press, 1932.
38. BLUM, LUCILLE H., & DRAGOSITZ, ANNA. Finger painting: the developmental aspects. *Child Develpm.*, 1947, **18**, 88–105.
39. BOAS, F. *Primitive art.* Cambridge, Mass.: Harvard Univ. Press, 1927.
40. BRICK, MARIA. Mental hygiene value of children's art work. *Amer. J. Orthopsychiat.*, 1944, **14**, 136–146.
41. BRILL, M. A study of instability using the Goodenough Drawing Scale. *J. abnorm. soc. Psychol.*, 1937, **32**, 288–302.
42. BROOKS, F. D. The relative accuracy of ratings assigned with and without use of drawing scales. *Sch. & Soc.*, 1928, **27**, 518–520.
43. BROWN, E. A., & GOITEIN, P. L. The significance of body image for personality assay. *J. nerv. ment. Dis.*, 1943, **97**, 401–408.
44. BRUEN, C. The artistic process. *Psyche*, 1930, **10**, 41–59. (*Psychol. Abstr.*, 1931, **5**, No. 459.)
45. BUCK, J. N. The H-T-P Test. *J. clin. Psychol.*, 1948, **4**, 151–159.
46. BUCK, J. N. The H-T-P technique: a qualitative and quantitative scoring technique. *J. clin. Psychol. Mon. Suppl.*, No. 5, Oct., 1948.
47. BÜHLER, CHARLOTTE. The Ball and Field Test as a help in the diagnosis of emotional difficulties. *Character & Pers.*, 1938, **6**, 257–273.
48. BURKHARDT, H. Über Verlagerung raümlicher Gestalten. (On the alteration of spatial form.) *Neue psychol. Stud.*, 1933, **7**, No. 3. (*Psychol. Abstr.*, 1935, **9**, No. 4394.)
49. BURTON, A., & TUELLER, ROMA. Successive reproductions of visually perceived forms. *J. genet. Psychol.*, 1941, **58**, 71–82.
50. CAIN, T. D. The objective measurement of accuracy in drawings. *Amer. J. Psychol.*, 1943, **56**, 32–53.
51. CAMERON, N. Individual and social factors in the development of graphic symbolization. *J. Psychol.*, 1938, **5**, 165–184.
52. CANE, FLORENCE. The gifted child in art. *J. educ. Sociol.*, 1936, **10**, 67–73.
53. CARROLL, H. A. A preliminary report on a study of the relationship between ability in art and certain personality traits. *Sch. & Soc.*, 1932, **36**, 285–288.
54. CATTELL, R. B. Personality traits associated with abilities. I. With intelligence and drawing ability. *Educ. psychol. Measmt*, 1945, **5**, 131–146.
55. CHANG, K. [Application of Goodenough's intelligence test by drawing in China.] *Chung Hwa educ. Rev.*, 1935, **23**, No. 5, 49–55. (*Psychol. Abstr.*, 1936, **10**, No. 5161.)
56. CHASE, JANE M. A study of the

drawings of a male figure made by schizophrenic patients and normal subjects. *Character & Pers.*, 1941, **9**, 208–217.

57. COCKRELL, D. L. Design in the paintings of young children. *Sch. Arts*, 1930, **30**, 33–39; 112–119.
58. COHEN, D. N. The Goodenough Drawing Scale applied to thirteen-year-old children. M. A. thesis, Columbia Univ., 1933. (Not seen.)
59. COOK, F. Art without sight. *Sch. Arts*, 1943, **43**, 40–45.
60. CURRAN, F. J. Art techniques for use in mental hospitals and correctional institutions. *Ment. Hyg., N. Y.*, 1939, **23**, 371–378.
61. DALLINGER, K. Über den Zusammenhang zwischen der Entwicklung des Ichbewusstseins mit dem kindlichen Zeichnen. (On the relationship between the development of the awareness of the self and the development of drawing in children.) In O. Tumitz (Ed.), *Jugendkundliche Arbeiten*, Vol. II. Langensalza: Beyer und Mann, 1928.
62. DANIELS, PARMELY C. Discrimination of compositional balance at the pre-school level. *Psychol. Monogr.*, 1933, **45**, No. 1, 1–11.
63. DATTA, A. Drawings of children. *Indian J. Psychol.*, 1935, **10**, 179–182. (*Psychol. Abstr.* 1936, **10**, No. 5559.)
64. DENNIS, W. The performance of Hopi children on the Goodenough Draw-a-Man Test. *J. comp. Psychol.*, 1942, **34**, 341–348.
65. DESPERT, J. LOUISE. Technical approaches used in the study and treatment of emotional problems in children. Part III. Drawing. *Psychiat. Quart.*, 1937, **11**, 267–295.
66. DIDE, M., & GUILHEM, M. Exploration psychologique infantile par l'expression graphique du mouvement. (A psychological investigation of graphic expression of movement by children.) *Mem. Acad. Sci., Toulouse*, 1929, **7**, 247–259. (*Psychol. Abstr.*, 1930, **4**, No. 3633.)
67. DOMS, F. P. Les échelles Gaublomme. Le graphisme et l'expression graphique. (The Gaublomme scales, writing and graphic expression.) *Sem. univ. Pédag. Univ. libre Brux.*, 1935, **1**, 171–182. (*Psychol. Abstr.*, 1936, **10**, No. 4140.)
68. DOW, MILDRED. Playground behavior differentiating artistic from non-artistic children. *Psychol. Monogr.*, 1933, **45**, No. 1, 82–94.
69. DOW, MILDRED. An observational study in a playground situation of differences in artistic personality at the child level. *Proc. Iowa Acad. Sci.*, 1933, **40**, 197.
70. DUBIN, ELISABETH R. The effect of training on the tempo of development of graphic representation in preschool children. *J. exp. Educ.*, 1946, **15**, 166–173.
71. DU BOIS, CORA. *The people of Alor.* Minneapolis: The University of Minnesota Press, 1944.
72. DUMONT, L. L'émotion esthétique chez l'enfant. (Esthetic emotion in the child.) *Bull. Instit. gén. Psychol.*, 1927, **27**, Nos. 1–3, 62–76, (*Psychol. Abstr.* 1928, **2**, No. 1066.)
73. DUNNETT, RUTH. *Art and child personality.* London: Methuen, 1948.
74. DYETT, E. G. The Goodenough Drawing Scale applied to college students. M. A. thesis, Columbia University, 1931. (Not seen.)
75. EARL, C. J. C. The human figure drawings of adult defectives. *J. ment. Sci.*, 1933, **79**, 305–328.
76. EARL, C. J. C. The human figure drawings of feeble-minded adults. *J. Psycho-Asth.*, 1933, **38**, 107–120.
77. Edelston, H. The analysis and treatment of a case of neurotic conduct disorder in a young child illustrat-

ing the value and use of drawing in child guidance technique. *J. ment. Sci.*, 1939, **85**, 522–547.

78. EELLS, W. C. Mental ability of the native races of Alaska. *J. appl. Psychol.*, 1933, **17**, 417–438.
79. EGGERS, M. M. Comparison of Army Alpha and Goodenough Drawings in delinquent women. M. A. thesis, Columbia Univ., 1931. (Not seen.)
80. ELKISCH, PAULA. Children's drawings in a projective technique. *Psychol. Monogr.*, 1945, **58**, No. 1, 1–31.
81. ELKISCH, PAULA. The emotional significance of children's art work. *Childh. Educ.*, 1947, **23**, 236–241.
82. ELLSWORTH, FRANCES F. Elements of form in the free paintings of twenty nursery school children. *J. gen. Psychol.*, 1939, **20**, 487–501.
83. ENG, HELGA K. *The psychology of children's drawings.* New York: Harcourt, Brace, 1931. (First publishe din German, 1927.)
84. ENGERTH, G. Zeichenstörung bei Patienten mit Autotopagnosie. (Disorders of drawing in patients with autotopagnosia.) *Z. ges. Neurol. Psychiat.*, 1933, **143**, 381–402.
85. ENGLAND, A. O. A psychological study of children's drawings: comparison of public school, retarded, institutionalized, and delinquent children's drawings. *Amer. J. Orthopsychiat.*, 1943, **13**, 525–530.
86. ENGLAND, A. O. Non-structured approach to the study of children's fears. *J. clin. Psychol.*, 1946, **2**, 364–368.
87. ENGLAND, A. O. Cultural milieu and parental identification. *Nerv. Child*, 1947, **6**, 301–305.
88. FALLAIZE, E. N. Children's drawings and primitive art. *J. Educ. (Lond.)*, 1933, **65**, 142–143.
89. FARNSWORTH, P. R. Ratings in music, art, and abnormality in the first four grades. *J. Psychol.*, 1938, **6**, 89–94.
90. FINDLEY, W. G. Factor analysis of a short-item drawing test. *Psychol. Bull.*, 1936, **33**, 605.
91. FINGERT, H. H., KAGAN, JULIA R., & SCHILDER, P. The Goodenough Test in insulin and metrazol treatment of schizophrenia. *J. gen. Psychol.*, 1939, **21**, 349–365.
92. FLEMING, JOAN. Observations on the use of finger painting in the treatment of adult patients with personality disorders. *Character & Pers.*, 1940, **8**, 301–310.
93. FLEMMING, E. G. Personality and artistic talent. *J. educ. Sociol.*, 1934, **8**, 27–33.
94. FOLEY, J. P., & ANASTASI, ANNE. The work of the Children's Federal Art Gallery. *Sch. & Soc.*, 1938, **48**, 859–861.
95. FONTES, V. O sobrenatural nos desenhos infantis. (The supernatural in children's drawings.) *Criança portug.*, 1946–47, **6**, 71–100. (*Psychol. Abstr.*, 1948, **22**, No. 4329.)
96. FONTES, V., LEITE DA COSTA, M. I., & FERREIRA, A. Contribuição para o estudo do teste de Fay aplicado em crianças protuguesas. (Contribution to the study of the Fay test as used with Portuguese children.) *Criança portug.*, 1944, **3**, 13–34. (*Psychol. Abstr.*, 1945, **19**, No. 1057.)
97. FORDHAM, M. S. C. *The life of childhood.* London: K. Paul, Trench, Trubner and Co., 1944.
98. FREEMAN, MABEL. Drawing as a psychotherapeutic intermedium. *J. Psycho-Asth.*, 1936, **41**, 182–187.
99. GARRISON, S. C. Fine arts. *Rev. educ. Res.*, 1935, **5**, 45–47.
100. GECK, FRANCES J. The effectiveness of adding kinesthetic to visual and auditory perception in the teaching

of drawing. *J. educ. Res.*, 1947, **41**, 97–101.

101. GERALD, H. J. P. Inverted positions in children's drawings: report of two cases. *J. nerv. ment. Dis.*, 1928, **68**, 449–455.
102. GESELL, A., & AMES, LOUISE B. The development of directionality in drawing. *J. genet. Psychol.*, 1946, **68**, 45–61.
103. GITLITZ, H. B. The Goodenough Drawing Scale applied to fourteen-year-old children. M. A. thesis, Columbia Univ., 1933. (Not seen.)
104. GOODENOUGH, FLORENCE L. Racial differences in the intelligence of school children. *J. exp. Psychol.*, 1926, **9**, 388–397.
105. GOODENOUGH, FLORENCE L. Studies in the psychology of children's drawings. *Psychol. Bull.*, 1928, **25**, 272–283.
106. GOODENOUGH, FLORENCE L. Children's drawings. In C. Murchison (Ed.), *A Handbook of Child Psychology*, (1st Ed.). Worcester, Mass: Clark Univ. Press, 1931.
107. GRAEWE, H. *Untersuchung der Entwicklung des Zeichnens.* (A study of the development of drawing.) Halle: Hermann Schroedel, 1932.
108. GRAEWE, H. Das Tierzeichnen der Kinder. (The child's drawing of animals.) *Z. pädag. Psychol.*, 1935, **36**, 251–256; 291–300.
109. GRAEWE, H. Geschichtlicher Überblick der Psychologie des kindlichen Zeichnens. (Historical survey of the psychology of children's drawings.) *Arch. ges. Psychol.*, 1936, **96**, 103–220.
110. GREEN, G. H. A child's first attempts to interpret drawings. *J. genet. Psychol.*, 1928, **35**, 473–474.
111. GRIDLEY, PEARL F. Graphic representation of a man by four-year-old children in nine prescribed drawing situations. *Genet. Psychol. Monogr.*, 1938, **20**, 183–350.
112. GRIFFITHS, RUTH. *A study of imagination in early childhood and its function in mental development.* London: Kegan Paul, Trench, Trubner and Co., 1945.
113. GRIPPEN, VELMA B. A study of creative artistic imagination in children by the constant contact procedure. *Psychol. Monogr.*, 1933, **45**, No. 1, 63–81.
114. GUTTMANN, E., & MACLAY, W. S. Clinical observations on schizophrenic drawings. *Brit. J. med. Psychol.*, 1937, **16**, 184–205.
115. HARMS, E. Kinderkunst als diagnostiches Hilfsmittel bei infantilen Neurosen. (Child art as a diagnostic aid in child neuroses.) *Z. Kinderpsychiat.*, 1940, **6**, 129–143.
116. HARMS, E. Child art as an aid in the diagnosis of juvenile neuroses. *Amer. J. Orthopsychiat.*, 1941, **11**, 191–210.
117. HARMS, E. The psychology of formal creativeness: I. Six fundamental types of formal expression. *J. genet. Psychol.*, 1946, **69**, 97–120.
118. HARRIS, D. B. Review of *Painting and Personality* by Rose H. Alschuler and La Berta Hattwick. *Ment. Hyg., N. Y.*, 1948, **32**, 653–659.
119. HARTENSTEIN, ERNA. Aktuelle Kulturinhalte im Spiegel der Kinderzeichnung. (Actual manifestations of culture in the mirror of children's drawings.) *Z. Jugendk.*, 1934, **4**, 106–120.
120. HATANO, I. [The picture stories and suggestions to the education of drawing.] *Trans. Inst. Child Study* (Japanese), 1934, **16**, 811–830. (*Psychol. Abstr.*, 1935, **9**, No. 450.)
121. HAUBOLD, M. Bildbetrachtungen durch Kinder und Jugendliche (Versuche über das Unterscheiden von Bildern verschiedenen Stiles.) (Appreciation of pictures by children and adolescents. [Experiments on the discrimination of dif-

ferent styles of pictures.]) *Neue Psychol. Stud.*, 1933, **7**, No. 2. (*Psychol. Abstr.*, 1934, **8**, No. 5301.)

122. HAVIGHURST, R. J., GUNTHER, MINNA K., & PRATT, INEZ E. Environment and the Draw-a-Man Test: the performance of Indian children. *J. abnorm. soc. Psychol.*, 1946, **41**, 50–63.

123. HELLERSBERG, ELISABETH F. The Horn-Hellersberg Test and adjustment to reality. *Amer. J. Orthopsychiat.*, 1945, **15**, 690–710.

124. HETZER, HILDEGARD. Die symbolische Darstellung in der frühen Kindheit. (Symbolical representation in early childhood.) *Wiener Arb. z. päd. Psychol.*, 1926, **3**, 1–92. (*Psychol. Abstr.*, 1933, **7**, No. 6025.)

125. HICKS, J. A., & RALPH, DOROTHY W. The effects of practice in tracing the Porteus Diamond Maze. *Child Developm.*, 1931, **2**, 156–158.

126. HILDRETH, GERTRUDE. Developmental sequences in name writing. *Child Develpm.*, 1936, **7**, 291–303.

127. HILDRETH, GERTRUDE. *The child mind in evolution; a study of developmental sequences in drawing.* New York: King's Crown Press, 1941.

128. HILDRETH, GERTRUDE. War theme in children's drawings. *Childh. Educ.*, 1943, **20**, 121–127.

129. HILDRETH, GERTRUDE. The simplification tendency in reproducing designs. *J. genet. Psychol.*, 1944, **64**, 329–333.

130. HINRICHS, W. E. The Goodenough drawing in relation to delinquency and problem behavior. *Arch. Psychol.*, No. 175, 1935.

131. HOMMA, T. [The law of Prägnanz in the process of drawing figures.] *Jap. J. Psychol.*, 1937, **12**, 112–153. (*Psychol. Abstr.*, 1937, **11**, No. 4462.)

132. HSIAO, H. H. [Hsiao's revision of Goodenough's test of intelligence for children.] *Monogr. Psychol. Educ., Nat. cent. Univ.*, 1939, **4**, No. 1. (*Psychol. Abstr.*, 1941, **15**, No. 2836.)

133. HUANG, I. [*The psychology of children's drawings.*] Shanghai: Commercial Press, 1938. (*Psychol. Abstr.*, 1939, **13**, No. 3889.)

134. HURLOCK, ELIZABETH B. The spontaneous drawings of adolescents. *J. genet. Psychol.*, 1943, **63**, 141–156.

135. HURLOCK, ELIZABETH B., & THOMSON, J. L. Children's drawings: an experimental study of perception. *Child Developm.*, 1934, **5**, 127–138.

136. IINUMA, R., & WATANABE, K. [Observations on moving objects drawn by children. Orientation and motion of railway trains.] *Jap. J. Psychol.*, 1937, **12**, 393–408. (*Psychol. Abstr.*, 1938, **12**, No. 977.)

137. ISRAELITE, JUDITH. A comparison of the difficulty of items for intellectually normal children and mental defectives on the Goodenough Drawing Test. *Amer. J. Orthopsychiat.*, 1936, **6**, 494–503.

138. JOSEPH, ALICE, SPICER, ROSAMUND B., & CHESKY, JANE. *The desert people.* Chicago: Univ. of Chicago Press, 1949.

139. KATÔ, M. [A genetic study of children's drawings of man.] *Jap. J. exp. Psychol.*, 1936, **3**, 175–185. (*Psychol. Abstr.*, 1937, **11**, No. 3000.)

140. KERR, MADELINE. Children's drawings of houses. *Brit. J. med. Psychol.*, 1937, **16**, 206–218.

141. KERR, ROSE N. Art and the young child. *Sch. Arts*, 1936, **36**, 5–8.

142. KIENZLE, R. Das bildhafte Gestalten als Ausdruck per Persönlichkeit. (Pictorial forms as expressions of the personality.) Esslingen: Wilh. Langguth, 1932. (*Psychol. Abstr.*, 1933, **7**, No. 1878.)

143. KLINE, L. W., & CAREY, G. L. A

measuring scale for free-hand drawing: Part II. Design and composition. *Johns Hopkins Stud. Educ.*, 1933, No. 5, Part II.

144. KNAUBER, ALMA J. A study of the art ability found in very young children. *Child Develpm.*, 1931, **2**, 66–71.

145. KOBAYASHI, S. [A study on a variation of facsimilies drawn by children.] *Jap. J. Psychol.*, 1937, **12**, 375–392. (*Psychol. Abstr.*, 1938, **12**, No. 979.)

146. KOGA, Y., & NAKA, Y. [Studies on the ability to draw.] *Kyôiku Shinri Kenkyû*, 1939, **14**, 509–519; 581–590; 749–761. (*Psychol. Abstr.*, 1940, **14**, No. 3090.)

147. KRAUSS, R. Über graphischen Ausdruck. Eine experimentelle Untersuchung über das Erzeugen und Ausdeuten von gegenstandfreien Linien. (Concerning graphic expression. An experimental investigation of the production and interpretation of objectless lines.) *Beih. Z. angew. Psychol.*, No. 48, 1930.

148. KRETSCHMANN, O. Beiträge zur Frage nach der Vererbung der zeichnerischen Anlagen. (Contribution to the question of the inheritance of graphic talent.) *Arch. ges. Psychol.*, 1941, **108**, 267–316. (*Psychol. Abstr.*, 1942, **16**, No. 2645.)

149. KRIS, E. Bemerkungen zur Bildnerei der Geisteskranken. (Observation on the sculptures of the mentally ill.) *Imago. Lpz.*, 1936, **22**, 339–370. (*Psychol. Abstr.*, 1936, **10**, No. 5834.)

150. KRÜBER, W. Über das Aufzeichnen von Formen aus dem Gedächtnis. (Concerning the drawing of forms from memory.) *Z. angew. Psychol.*, 1938, **54**, 273–327.

151. LABUNSKAYA. Infantile drawing. *Sch. Arts*, 1934, **33**, 368–371.

152. LANDISBURG, SELMA. A study of the H-T-P Test. *Train. Sch. Bull.*, 1947, **44**, 140–152.

153. LANGE, B. Zur Psychologie der Zeichnenunterrichts. (The educational psychology of drawing.) *Int. Z. Indiv.-Psychol.*, 1933, **11**, 295–301.

154. LARK-HOROVITZ, BETTY. Interlinkage of sensory memories in relation to training in drawing. *J. genet. Psychol.*, 1936, **49**, 69–89.

155. LARK-HOROVITZ, BETTY. On learning abilities of children as recorded in a drawing experiment: I. Subject matter. *J. exp. Educ.*, 1941, **9**, 332–345.

156. LARK-HOROVITZ, BETTY. Comparison of subjective and objective judgments of children's drawings. *J. exp. Educ.*, 1942, **10**, 153–163.

157. LARK-HOROVITZ, BETTY, BARNHART, E. N., & SILLS, ESTHER M. *Graphic work-sample diagnosis: an analytic method of estimating children's drawing ability.* Cleveland, Ohio: Cleveland Museum of Art, 1939.

158. LASSEN, H. Raumauffassung und Raumdarstellung in Kinderzeichnungen. (Space perception and representation in children's drawings.) *Arch. ges. Psychol.*, 1943, **112**, 153–195. (*Psychol. Abstr.*, 1946, **20**, No. 2526.)

159. LEGRÜN, A. Zur Deutung von Kinderkritzelein. (On the significance of children's scribbling.) *Z. Kinderforsch.*, 1938, **47**, 236–249.

160. LEIGHTON, DOROTHEA, & KLUCKHOHN, CLYDE. *Children of the people.* Cambridge, Mass.: Harvard Univ. Press, 1947.

161. LEMBKE, W. Über Zeichnungen von "frechen" und "schüchternen" Schulkindern. (The significance of drawings by "bold" and "shy" pupils.) *Z. päd. Psychol.*, 1930, **31**, 459–462.

162. LERNER, E., MURPHY, LOIS B., *et. al.* Methods for the study of person-

ality in young children. *Monogr. Soc. Res. Child Develpm.*, 1941, **6**, No. 4. Washington, D.C.: National Research Council.

163. LEVY, J. The use of art techniques in treatment of children's behavior problems. *J. Psycho-Asth.*, 1934, **39**, 258–260.

164. LEVY, L. R. The function of the Goodenough Drawing Scale in the study of high school freshmen. M. A. thesis, Columbia Univ., 1931. (Not seen.)

165. LEWERENZ, A. S. IQ and ability in art. *Sch. & Soc.*, 1928, **27**, 489–490.

166. LEWIN, K. *A dynamic theory of personality.* New York and London: McGraw-Hill, 1935.

167. LEWIS, N. D. C. Graphic art productions in schizophrenia (dementia praecox). *Proc. Assn. Res. nerv. ment. Dis. for 1925*, **5**, 344–368. New York: Paul B. Hoeber, Inc., 1928.

168. LIESE, E. Die freihandzeichnen bei kindlicher Selbständigkeit und unter Berücksichtgung des kindlichen Vermögens. (Freehand drawing and self-reliance in children with special reference to natural ability.) Langensalza: Beltz, 1931. (*Psychol. Abstr.*, 1933, **7**, No. 2084.)

169. LISS, E. Play techniques in child analysis. *Amer. J. Orthopsychiat.*, 1936, **6**, 17–22.

170. LOCH, M. Über Eidetik und Kinderzeichnung. (Concerning eidetic imagery and children's drawings.) *Arb. a.d. Psychol., Inst. d. München*, 1931, No. 2. (*Psychol. Abstr.*, 1933, **7**, No. 328.)

171. LORD, E., & WOOD, L. Diagnostic values in a visuo-motor test. *Amer. J. Orthopsychiat.*, 1942, **12**, 414–428.

172. LÖWENFELD, V. *The nature of creative activity.* New York: Harcourt, Brace and Co., 1939.

173. LÖWENFELD, V. Self-adjustment through creative activity. *Amer. J. ment. Def.*, 1941, **45**, 366–373.

174. LÖWENFELD, V. *Creative and mental growth.* New York: Macmillan Co., 1947.

175. LUQUET, G. H. Le réalisme intellectuel dans l'art primitif. II. Le rendu de visible. (Intellectual realism in primitive art. II. Rendition tion of the visible.) *J. de Psychol.*, 1927, **24**, 888–927.

176. LUQUET, G. H. L'évolution du dessin enfantin. (The evolution of children's drawings.) *Bull. Soc. Binet*, 1929, **29**, 145–163.

177. LUQUET, G. H. *L'art primitif.* (Primitive art.) Paris: Doin, 1930. (*Psychol. Abstr.*, 1931, **5**, No. 1569.)

178. MCADORY, M. The construction and validation of an art test. *Teach. Coll. Contr. Educ.*, No. 383, New York: Teachers' College, Columbia Univ., Bureau of Pub., 1929.

179. MCCARTHY, DOROTHEA. A study of the reliability of the Goodenough Test of intelligence. *J. Psychol.*, 1944, **18**, 201–216.

180. MCCLOY, W. Creative imagination in children and adults. *Psychol. Monogr.*, 1939, **51**, 88–102.

181. MCCURDY, H. G. Group and individual variability on the Goodenough Draw-a-Man Test. *J. educ. Psychol.*, 1947, **38**, 428–436.

182. MCELWEE, EDNA W. The reliability of the Goodenough intelligence test used with sub-normal children fourteen years of age. *J. appl. Psychol.*, 1932, **16**, 217–218.

183. MCELWEE, EDNA W. Profile drawings of normal and subnormal children. *J. appl. Psychol.*, 1934, **18**, 599–603.

184. MACGREGOR, GORDON. *Warriors without weapons.* Chicago: Univ. of Chicago Press, 1946.

185. MCHUGH, G. Changes in Goodenough IQ at the public school kindergarten level. *J. educ. Psychol.*, 1945, **36**, 17–30.

186. McHUGH, G. Relationship between the Goodenough Drawing a Man Test and the 1937 Revision of the Stanford-Binet Test. *J. educ. Psychol.*, 1945, **36**, 119–124.

187. McINTOSH, JANETTE R. An inquiry into the use of children's drawings as a means of psychoanalysis. *Brit. J. educ. Psychol.*, 1939, **9**, 102–103.

188. McINTOSH, JANETTE R., & PICKFORD, R. W. Some clinical and artistic aspects of a child's drawings. *Brit. J. med. Psychol.*, 1943, **19**, 342–362.

189. MACHOVER, KAREN. *Personality projection in the drawing of the human figure.* Springfield, Ill.: C. C Thomas, 1949.

190. MANUEL, H. T., & HUGHES, LOIS S. The intelligence and drawing ability of young Mexican children. *J. appl. Psychol.*, 1932, **16**, 382–387.

191. MARCUCCI, H. Fanciulli che disegnano. (Children who design.) *Rass. dell'istruz. artistica*, 1932, **3**, 171–180. (*Psychol. Abstr.*, 1933, **7**, No. 3019.)

192. MARTIN, H. Stile und Stilwandlungsgesetze der Kinderzeichnung, nachgewiesen an den Menschenzeichnungen der Volksschulkinder. (Style and laws of change in style in children's drawing of a man by folks school children.) *Vjsch. Jugendk.*, 1932, **2**, 211–226. (*Psychol. Abstr.*, 1933, **7**, No. 2086.)

193. MARTIN, H. Die Motivwahl und ihr Wandel in der freien Zeichnung des Grundschulkindes. (Choice of subject and its changes in the free drawings of elementary school children.) *Z. pädag. Psychol.*, 1939, **40**, 231–241.

194. MEIER, N. C. Special artistic talent. *Psychol. Bull.*, 1928, **25**, 265–271.

195. MEIER, N. C. (Ed.) Studies in the psychology of art. *Psychol. Monogr.*, 1933, **45**, No. 1.

196. MEIER, N. C. Studies in the foundations of artistic aptitude. *Proc. Iowa Acad. Sci.*, 1933, **40**, 195–196.

197. MEIER, N. C. Art ability without instruction or environmental background: case study of Loran Lockhart. *Psychol. Monogr.*, 1936, **48**, No. 1, 155–163.

198. MEIER, N. C. Factors in artistic aptitude: final summary of a ten-year study of a special ability. *Psychol. Monogr.*, 1939, **51**, No. 5, 140–158.

199. MEIER, N. C. Recent research in the psychology of art. *Yearb. nat. Soc. Stud. Educ.*, 1941, **40**, 379–400.

200. MEIER, N. C., & SEASHORE, C. E. *The Meier-Seashore Art Judgment Test*, 1929. Revised, 1940 by N. C. Meier under title *The Meier Art Test.* Iowa City, Iowa: Bureau of Educ. Res. and Serv., 1940.

201. MELOUN, J. Does drawing skill show in handwriting? *Character & Pers.*, 1935, **3**, 194–213.

202. MENZEL, E. W. The Goodenough Intelligence Test in India. *J. appl. Psychol.*, 1935, **19**, 615–624.

203. MERRY, RUTH C. Art talent and racial background. *J. educ. Res.*, 1938, **32**, 17–22.

204. MERZBACH, A. Symbolische Selbstzeichnungen aus der Psychose eines Jugendlichen und ihre Verwertbarkeit. (Symbolical self-pictures during a psychotic attack in an adolescent and their interpretation.) *Z. ges. Neurol. Psychiat.*, 1930, **127**, 240–251.

205. MILLER, J. Intelligence testing by drawings. *J. educ. Psychol.*, 1938, **29**, 390–394.

206. MIRA, E. Myokinetic psychodiagnosis: a new technique for exploring the conative trends of personality. *Proc. roy. Soc. Med.*, 1940, **33**, 173–194.

207. MITCHELL, W. W. *Drawing aptitude test.* Bloomington, Ill.: McKnight and McKnight, 1940. (Not seen.)

208. MOHR, P. Das künstlerische Schaffen Geisteskranker und seine Beziehungen zum Verlauf der Krank-

heit. (The artistic work of psychotics and its relation to the course of the disease.) *Schweiz. Arch. Neurol. Psychiat.*, 1940, **45**, 427–446. (*Psychol. Abstr.*, 1941, **15**, No. 2625.)

209. MORGENSTERN, L. L'art plastique et le problème de l'espace. (Plastic art and the problem of space.) *J. de Psychol.*, 1931, **28**, 473–480.
210. MORGENSTERN, S. Le symbolisme et la valeur psychoanalytique des dessins infantiles. (Symbolism and the psychoanalytic value of children's drawings.) *Rev. franç. Psychanal.*, 1939, **11**, 39–48. (*Psychol. Abstr.*, 1939, **13**, No. 6548).
211. MOTT, SINA M. The development of concepts. *J. genet. Psychol.*, 1936, **48**, 199–214.
212. MOTT, SINA M. The development of concepts: a study of children's drawings. *Child Develpm.*, 1936, **7**, 144–148.
213. MOTT, SINA M. The growth of an abstract concept. *Child Develpm.*, 1939, **10**, 21–25.
214. MOTT, SINA M. Muscular activity as an aid in concept formation. *Child Develpm.*, 1945, **16**, 97–109.
215. MUNRO, T., LARK-HOROVITZ, BETTY, & BARNHART, E. N. Children's art abilities: Studies in the Cleveland Museum of Art. *J. exp. Educ.*, 1942, **11**, 97–155.
216. MUNROE, RUTH, LEWINSON, THEA S., & WAEHNER, TRUDE S. A comparison of three projective techniques. *Character & Pers.*, 1944, **13**, 1–21.
217. NABER, LOUISE. Relation of child art to primitive art. *Proc. nat. Educ. Assn.*, 1937, **75**, 208–209.
218. NAKAE, J. [Children's ways of representing a solid body.] *Kyôiku Shinri Kenkyû*, 1939, **14**, 105–117. (*Psychol. Abstr.*, 1940, **14**, No. 3280.)
219. NAPOLI, P. J. Finger painting and personality diagnosis. *Genet. Psychol. Monogr.*, 1946, **34**, 129–231.
220. NAPOLI, P. J. Finger painting: a bibliography. *Sch. Arts*, 1947, **46**, 208–210.
221. NAPOLI, P. J., & HARRIS, W. W. Finger painting for the blind. *J. Psychol.*, 1948, **25**, 185–196.
222. NATIONAL SOCIETY FOR THE STUDY OF EDUCATION. *Art in American Life and Education*. Fortieth Year book, Bloomington, Ill.: Public School Pub. Co., 1941.
223. NAUMBURG, MARGARET. The drawings of an adolescent girl suffering from anxiety hysteria with amnesia. *Psychiat. Quart.*, 1941, **18**, 197–224.
224. NAUMBURG, MARGARET. Children's art expression and war. *Nerv. Child*, 1942, **2**, 360–373.
225. NAUMBURG, MARGARET. A study of the art expression of a behavior problem boy as an aid to diagnosis and therapy. *Nerv. Child*, 1944, **3**, 277–319.
226. NAUMBURG, MARGARET. The psychodynamics of the art expression of a boy patient with tic syndrome. *Nerv. Child*, 1945, **4**, 374–409.
227. NAUMBURG, MARGARET. Fantasy and reality in the art expression of behavior problem children. In Lewis, N. D. C., and Pacella, B. L., *Modern trends in child psychiatry*. New York: International Univ. Press, 1945. Pp. 193–218.
228. NAUMBURG, MARGARET. A study of the psychodynamics of the art work of a nine-year-old behavior problem boy. *J. nerv. ment. Dis.*, 1945, **101**, 28–64.
229. NAUMBURG, MARGARET. A study of the art work of a behavior problem boy as it relates to ego development and sexual enlightenment. *Psychiat. Quart.*, 1946, **20**, 74–112.
230. NAUMBURG, MARGARET. Studies of the "free" art expression of be-

havior problem children and adolescents as a means of diagnosis and therapy. *Nerv. and ment. Dis. Monogr.*, No. 71. New York: Coolidge Foundation, 1947.

231. NEUBAUER, V. Zur Entwicklung der dekorativen Zeichnung. (The development of decorative drawing.) *Z. angew. Psychol.*, 1931, **39**, 273–325. (*Psychol. Abstr.*, 1931, **5**, No. 4266.)

232. OAKLEY, C. A. The interpretation of children's drawings. *Brit. J. Psychol.*, 1931, **21**, 256–270.

233. OAKLEY, C. A. Drawings of a man by adolescents. *Brit. J. Psychol.*, 1940, **31**, 37–60.

234. OBERLIN, D. S. Children who draw. *Delaware St. med. J.*, 1938, **10**. (*Psychol. Abstr.*, 1938, **12**, No. 5609.)

235. OKERBLOOM, ELIZABETH C. Hoyt Sherman's experimental work in the field of visual form. *College Art J.*, 1944, **3**, 143–147.

236. ØSTLYNGEN, E. [On the direction of drawings.] *Studia Psychol. Paedagog., Lund.*, 1948, **2**, 206–210. (*Psychol. Abstr.*, 1948, **22**, No. 4322.)

237. PAGET, G. W. Some drawings of men and women made by children of certain non-European races. *J. roy. Anthrop. Inst.*, 1932, **62**, 127–144.

238. PARLOG, C. *Psihologia desemnului.* (*Psychology of drawing.*) Cluj, Roumania: Inst. de Psihol. Univ. Cluj, 1932. (*Psychol. Abstr.*, 1934, **8**, No. 3195.)

239. PAULSSON, G. The creative element in art. *Scand. Sci. Rev.*, 1923, **2**, 11–173.

240. PEARSON, G. H. J. Inverted position in children's drawings: report of two cases. *J. nerv. ment. Dis.*, 1928, **68**, 449–455.

241. PECK, LEIGH. An experiment with drawing in relation to the prediction of school success. *J. appl. Psychol.*, 1936, **20**, 16–43.

242. PELIKAN, A. G. *The art of the child.* New York: Bruce Publ. Co., 1931. (*Psychol. Abstr.*, 1932, **6**, No. 467.)

243. PETERSON, E. G., & WILLIAMS, J. M. Intelligence of deaf children as measured by drawings. *Amer. Ann. Deaf*, 1930, **75**, 273–290.

244. PFISTER, H. O. Farbe und Bewegung in der Zeichnung Geisteskranker. (Color and movement in the drawings of mental patients.) *Schweiz. Arch. Neurol. Psychiat.*, 1934, **34**, 325–365.

245. PHILLIPS, E., & STROMBERG, E. A comparative study of finger-painting performance in detention home and high school pupils. *J. Psychol.*, 1948, **26**, 507–515.

246. PINTNER, R. Artistic appreciation among deaf children. *Amer. Ann. Deaf*, 1941, **86**, 218–224.

247. PIOTROWSKA, I., & SOBESKI, M. The primitive. *J. Aesthet.*, 1941, **1**, 12–21.

248. PORTOCARRERO DE LINARES, GRACIELA-VERA. El desarrollo del dibujo imatativo en la población femenina de Lima. (The modification of imitative drawing in the feminine population of Lima.) *Bol. Inst. psicopedag. nac. Lima*, 1948, **7**, 47–148.

249. POWEL, LYDIA. *The art museum comes to the school.* New York: Harper and Bros., 1944.

250. PRUDHOMME, M. *Le dessin de l'enfant.* (The child's drawing.) Paris: Presses Universitaires de France, 1947.

251. RABELLO, S. Caractericas do desenho infantil. Contribução para o estudo psychologico da criança brasileira. (Characteristics of children's drawings. A contribution to the psychological study of Brazilian children.) *Bol. Direct. tech. Educ., Pernambuco*, 1932, **2**,

15–78. (*Psychol. Abstr.*, 1935, **9**, No. 3035.)

252. RAY, ANDRÉ. Épreuves de dessin; témoins du développement mental. (Drawing tests as evidence of mental development.) *Arch. Psychol., Genève*, 1946, **31**, 369–380. (*Psychol. Abstr.*, 1947, **21**, No. 4178.)

253. RAY, ANDRÉ. Épreuves de dessin; témoins du développement mental: II. Reproduction d'objets simples selon différents points de vue. (Drawing tests as evidence of mental development: II. Reproduction of simple objects from different points of view.) *Arch. Psychol., Genève.*, 1947, **32**, 145–160. (*Psychol. Abstr.*, 1948, **22**, No. 2828.)

254. READ, H. E. *Education through art.* London: Faber and Faber, 1943.

255. REITMANN, F. Facial expression in schizophrenic drawings. *J. ment. Sci.*, 1939, **85**, 264–272.

256. RICE, CHARLOTTE. Excellence of production and types of movements in drawing. *Child Develpm.*, 1930, **1**, 1–14.

257. RODGERS, FRANCES. Variation in the aesthetic environment of artistic and non-artistic children. *Psychol. Monogr.*, 1933, **45**, No. 1, 95–107.

258. ROSTOHAR, M. Studiez vyvojové psychologie. Dil. I. (Studies in developmental psychology.) Brno: Opera Facult. Philosoph. Universit. Masarykian. Brunensis, Cisto 25, 1928. (*Psychol. Abstr.*, 1930, **4**, No. 805.)

259. ROUMA, G. Dessins d' indiens quitchouas et aymaras. La graphisme et l'expression graphique. (Drawings of the Quechua and the Aymara Indians. Writing and graphic expression.) *Sem. univ. Pédag., Univ. libre Brux.*, 1935, **1**, 133–147. (*Psychol. Abstr.*, 1936, **10**, No. 4173.)

260. RUESCH, J., & FINESINGER, J. E. The relation of the Rorschach color response to the use of color in drawings. *Psychosom. Med.*, 1941, **3**, 370–388.

261. RUSSELL, R. W. The spontaneous and instructed drawings of Zuni children. *J. comp. Psychol.*, 1943, **35**, 11–15.

262. SAUNDERS, A. W. The stability of artistic aptitude at the childhood level. *Psychol. Monogr.*, 1936, **48**, 126–154.

263. SCHAEFER-SIMMERN, H. *The unfolding of artistic activity, its basis, processes, and implications.* Berkeley: Univ. California Press, 1948.

264. SCHEER, G. Ausdrucksfaktoren in der zeichnerischen Entwicklung des Pubertätsalters. (Expressive factors in the development of drawing during adolescence.) *Arch. ges. Psychol.*, 1934, **92**, 1–25.

265. SCHILDER, P. The child and the symbol. *Scientia*, 1938, **64**, 21–26.

266. SCHILDER, P., & LEVINE, E. L. Abstract art as an expression of human problems. *J. nerv. ment. Dis.*, 1942, **95**, 1–10.

267. SCHLIEBE, G. Erlebnismotorik und zeichnerischer (physiognomischer) Ausdruck bei Kindern und Jugundlichen. (Zur Psychogenese der Ausdruckesgestaltung) (Kinesthetic experience and graphic [physiognomical] expression among children and adolescents. [On the psychogenesis of the expression of form.]) *Z. Kinderforsch.*, 1934, **43**, 49–76.

268. SCHMIDL-WAEHNER, TRUDE. Formal criteria for the analysis of children's drawings. *Amer. J. Orthopsychiat.*, 1942, **12**, 95–103.

269. SCHUBE, P., & COWELL, J. Art of psychotic persons. *Arch. Neurol. Psychiat., Chicago*, 1939, **41**, 709–720.

270. SCHUBERT, ANNA. Drawings of Orotchen children and young peo-

ple. *J. genet. Psychol.*, 1930, **37**, 231–244.

271. SEEMAN, E. Development of the pictorial aptitude in children. *Character & Pers.*, 1934, **2**, 209–221.
272. SEEMAN, E., & SAUDEK, R. The self-expression of identical twins in handwriting and drawing. *Character & Pers.*, 1932, **1**, 91–128.
273. SHAFFER, L. F. Children's interpretations of cartoons. *Teach. Coll. Contr. Educ.*, No. 429. New York: Bureau of Pub., Teachers' College, Columbia Univ., 1930.
274. SHAW, RUTH F. *Finger painting.* Boston: Little, Brown and Co., 1934. (*Psychol. Abstr.*, 1935, **9**, No. 5969.)
275. SHIRLEY, MARY, & GOODENOUGH, FLORENCE L. A survey of intelligence of deaf children in Minnesota schools. *Amer. Ann. Deaf*, 1932, **77**, 238–247.
276. SIGG-BOEDDINGHAUS, M. Zeichnen und Malen und ihre Bedeutung für die seelische Entwicklung des Kindes. (Drawing and painting; their significance for the mental development of the child.) *Psychol. Rundschau*, 1929, **1**, 222–229; 324–330. (*Psychol. Abstr.*, 1930, 4, Nos. 2185, 2470.)
277. SLOCHOWER, MURIEL Z. Experiments on dimensional and figural processes in the clay and pencil reproductions of line figures by young children: I. Dimension. *J. genet. Psychol.*, 1946, **69**, 57–75.
278. SLOCHOWER, MURIEL Z. Experiments on dimensional and figural problems in the clay and pencil reproductions of line figures by young children: II. Shape. *J. genet. Psychol.*, 1946, **69**, 77–95.
279. SORGE, S. Neue Versuche über die Wiedergabe abstraktes optischer Gebilde. (A new experiment on the reproduction of abstract visual forms.) *Arch. ges. Psychol.*, 1940, **106**, 1–89.
280. SPIELREIN, S. Kinderzeichnungen bei offnen und geschlossenen Augen; Untersuchungen über die unterschwelligen kinästhetischen Vorstellungen. (Children's drawings with the eyes open and shut: researches on kinesthetic images below the threshold of consciousness.) *Imago*, 1931, **17**, 359–391. (*Psychol. Abstr.*, 1932, **6**, No. 2966.)
281. SPOERL, DOROTHY T. Personality and drawing in retarded children. *Character & Pers.*, 1940, **8**, 227–239.
282. SPOERL, DOROTHY T. The drawing ability of mentally retarded children. *J. genet. Psychol.*, 1940, **57**, 259–277.
283. SPOERL, DOROTHY T. A note on the Anastasi-Foley cultural interpretation of children's drawings. *J. soc. Psychol.*, 1941, **13**, 187–192.
284. SPRINGER, N. N. A comparative study of the intelligence of a group of deaf and hearing children. *Amer. Ann. Deaf*, 1938, **83**, 138–152.
285. SPRINGER, N. N. A study of the drawings of maladjusted and adjusted children. *J. genet. Psychol.*, 1941, **58**, 131–138.
286. STEGGERDA, M. The McAdory Art Test applied to Navaho Indian children. *J. comp. Psychol.*, 1936, **22**, 283–285.
287. STEGGERDA, M. *Maya Indians of Yucatan.* Washington, D.C.: Carnegie Institution of Washington, 1941.
288. STOLZ, ALBERTA, & MANUEL, H. T. The art ability of Mexican children. *Sch. & Soc.*, 1931, **34**, 379–380.
289. TAYLOR, W. S. A note on cultural determination of free drawings. *Character & Pers.*, 1944, **13**, 30–36.
290. TELFORD, C. W. Test performance of

full and mixed-blood North Dakota Indians. *J. comp. Psychol.*, 1932, **14**, 123–145.

291. THIEL, G. Eine Untersuchung von Kinderzeichnungen taubstummer Schüler. (A research on the drawings of deaf children.) *Z. Kinderforsch.*, 1927, **33**, 138–176.

292. THOMPSON, LAURA, & JOSEPH, ALICE. *The Hopi way.* Chicago: Univ. of Chicago Press, 1945.

293. TIEBOUT, CAROLYN. The psychophysical functions differentiating artistically superior from artistically inferior children. *Psychol. Monogr.*, 1933, **45**, No. 1, 108–133.

294. TIEBOUT, CAROLYN. The measurement of psychophysical functions characteristic of extreme degrees of artistic capacity. *Proc. Iowa Acad. Sci.*, 1933, **40**, 197.

295. TIEBOUT, CAROLYN. The measurement of quality in children's painting by the scale method. *Psychol. Monogr.*, 1936, **48**, No. 1, 85–94.

296. TIEBOUT, CAROLYN, & MEIER, N. C. Artistic ability and general intelligence. *Psychol. Monogr.*, 1936, **48**, No. 1, 95–125.

297. TODD, JESSIE M. *Drawing in the elementary school.* Chicago: Univ. Chicago Press, 1931.

298. TOMLINSON, R. R. *Picture making by children.* London: The Studio, Ltd., 1934.

299. TOMLINSON, R. R. *Children as artists.* London: The King Penguin Books, 1944.

300. TRAUBE, T. Le valeur diagnostique des dessins des enfants difficiles. (The diagnostic value of drawings of problem children.) *Arch. Psychol., Genève*, 1937, **26**, 285–309.

301. VAUGHN, C. L., & HOOSE, ELIZABETH S. Special abilities in a mentally deficient boy. *J. Psycho-Asth.*, 1936, **41**, 197–207.

302. VEDDER, R. Over het copieren von eenvoudige geometrische figuren door oligophrenen en jonge kinderen. (The copying of simple geometric figures by feebleminded and young children.) Amsterdam: N. V. Noord-Hollandsche Uitgevers Maatschappi, 1939. (*Psychol. Abstr.*, 1940, **14**, No. 4633.)

303. VIOLA, W. *Child art.* London: Univ. of London Press, 1942.

304. VOGELSANG, H. Aus der Ideenwelt jugendlicher Rechtsbrecher. (The mental world of the young lawbreaker.) *Z. Jugendk.*, 1934, **4**, 120–125.

305. VOSS, MILDRED D. A study of conditions affecting the functioning of the art appreciation process at the child-level. *Psychol. Monogr.*, 1936, **48**, No. 1, 1–39.

306. VOSS, MILDRED D. The validity and reliability of a modified form of the McAdory Art Test for use at lower grade levels. *Psychol. Monogr.*, 1936, **48**, No. 1, 68–84.

307. VYDRA, J. Stammesunterschiede in der Begabung des Kindes für bildende Kunst. (Racial differences in children's talent for pictorial art.) 4 *Versamml. f. Kinderforsch.*, Bratislava, 1932, 311–314. (*Psychol. Abstr.*, 1933, **7**, No. 4091.)

308. WAEHNER, TRUDE S. Interpretations of spontaneous drawings and paintings. *Genet. Psychol. Monogr.*, 1946, **33**, 3–70.

309. WARTEGG, E. Gestaltung und Charakter. (Organization and character.) *Beih. Z. angew. Psychol.*, 1939, No. 84.

310. WARTEGG, E. *Gestaltung und Charakter. Ausdrucksdeutung zeichnerischer Gestaltung und Entwurf einer charakterologischen Typologie.* (Form and character. Interpretation of expression from drawings and an outline of characterological typology.) Leipzig: J. A. Barth,

1939. (*Psychol. Abstr.*, 1941, **15**, No. 4720.)

311. WECHSLER, D., & HARTOGS, R. The clinical measurement of anxiety. *Psychiat. Quart.*, 1945, **19**, 618–635.
312. WHITE, ROBERTA, & JOHNSON, BUFORD. Children's choices in modern art. *Child Develpm.*, 1930, **1**, 347–349.
313. WIGGIN, R. *Developmental stages of drawing expression.* (Mimeographed) Author: College Park, Md., 1948.
314. WILLIAMS, J. H. Validity and reliability of the Goodenough Intelligence Test. *Sch. & Soc.*, 1935, **41**, 653–656.
315. WILLIAMS, J. N. Interpretation of the drawings made by maladjusted children. *Virginia med. Mon.*, 1940, **67**, 533–538.
316. WILLIAMS, M. L. The growth of intelligence as measured by the Goodenough Drawing Test. *J. appl. Psychol.*, 1930, **14**, 239–256.
317. WINTSCH, J. Le dessin comme témoin du développement mental. (Drawing as evidence of mental development.) *Z. Kinderpsychiat.*, 1935, **2**, 33–44; 69–83.
318. WITMER, HELEN L. (Ed.) *Psychiatric interviews with children.* New York: Commonwealth Fund, 1946.
319. WOLFF, W. "Graphometry": a new diagnostic method. *Psychol. Bull.*, 1942, **39**, 465.
320. WOLFF, W. Projective methods for personality analysis of expressive behavior in preschool children. *Character & Pers.*, 1942, **10**, 309–330.
321. WOLFF, W. *The personality of the preschool child; the child's search for his self.* New York: Grune and Stratton, 1946.
322. WOLFF, W. *Diagrams of the unconscious.* New York: Grune and Stratton, 1948.
323. WOOD, L., & SHULMAN, E. The Ellis visual designs test. *J. educ. Psychol.*, 1940, **31**, 591–602.
324. YEPSON, L. N. The reliability of the Goodenough Drawing Test with feebleminded subjects. *J. educ. Psychol.*, 1929, **20**, 448–451.
325. ZACHRY, CAROLINE B. The role of art in personality development. *Ment. Hyg.*, (N.Y.), 1933, **17**, 51–58.
326. ZAMBALDI, I. La scuola attiva e il metodo d'insegnamento. Il disegno. (The active school and the method of teaching. Design.) *Riv. pedag.*, 1934, **27**. (*Psychol. Abstr.*, 1935, **9**, No. 2005.)
327. ZESBAUGH, HELEN A. *Children's drawings of the human figure.* Chicago: Univ. of Chicago Press, 1934.
328. ZILAHI-BEKE, A. Zusammenhänge zwischen Kunst- und Charakterentwicklung. (Relationship between art and character development.) *Int. Z. Indiv.-Psychol.*, 1931, **9**, 51–60.
329. ZILGITT, HELEN H. Relationships in child development. *Design.* 1935, **37**, 26–27.
330. ZIMMERMAN, J., & GARFINKLE, L. Preliminary study of the art productions of the adult psychotic. *Psychiat. Quart.*, 1942, **16**, 313–318.

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ON THE VALIDITY OF INFERENCES DRAWN FROM THE FITTING OF POISSON AND NEGATIVE BINOMIAL DISTRIBUTIONS TO OBSERVED ACCIDENT DATA

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I. Introduction

In a recent article Mintz and Blum (3) pointed out that the so-called "Method of Percentages" sometimes used to expose accident proneness is fallacious. With this statement the writer is in agreement, but it is felt at the same time that the method proposed by the authors of the above-mentioned article may lead to erroneous conclusions if the underlying assumptions are not met with in practice. Mintz and Blum accept the satisfactory representation of a set of accident data by the Negative Binomial distribution as sufficient evidence that there exists accident proneness in the group from which the data originated. Conversely, a good Poisson "fit" should indicate absence of proneness. That such an interpretation of the Negative Binomial law may not always be in accordance with the facts has recently been stated by Greenwood (2), one of the pioneers in statistical analysis of accident data.

It is known that a composite of only two Poisson distributions can well be represented by the Negative Binomial law so that in this article attention will be given to Poisson and Negative Binomial distributions only (5). It is the object of this paper to show, firstly, that a perfect Poisson "fit" does not exclude proneness, and secondly, that a good Negative Binomial "fit" need not indicate accident proneness.

The most direct method of establishing proneness in a group of people, all of whom ought to be exposed to the same environmental risk, consists of splitting a lengthy period of observation into two and correlating the frequency of accidents per individual for these two periods. This statistical technique is nearest to the psychological definition of accident proneness. As accident distributions are far from normal, the resulting product-moment coefficient r can only be interpreted as a sloping constant of the regression lines, these being the lines of best fit to the data in the sense of least squares. Ordinarily, however, proneness is established from univariate distributions by comparing the variance of the accident data with the mean. The justification of

this procedure may be found in the mathematical relationship of the correlation coefficient between the number of accidents in two sucessive periods and the parameters of the Negative Binomial law (Newbold, 4).

II. Poisson Distribution

A well known discrete bivariate law with marginal distributions of the Poisson type and non-zero correlation is given by Aitken (1) as:

$$p(x, y) = e^{-\lambda_1-\lambda_2+\lambda_3}\frac{(\lambda_1-\lambda_3)^x(\lambda_2-\lambda_3)^y}{x!y!}\left\{1+\frac{xy}{(\lambda_1-\lambda_3)(\lambda_2-\lambda_3)}\frac{\lambda_3}{1!}\right.$$
$$\left.+\frac{x(x-1)y(y-1)}{(\lambda_1-\lambda_3)^2(\lambda_2-\lambda_3)^2}\frac{\lambda_3^2}{2!}+\cdots\right\}. \qquad [1]$$

For the marginal distributions we find by summation from equation [1],

$$\left.\begin{aligned} p(x) &= e^{-\lambda_1}\frac{\lambda_1^x}{x!} \\ p(y) &= e^{-\lambda_2}\frac{\lambda_2^y}{y!} \end{aligned}\right\}. \qquad [2]$$

The following example has been constructed to illustrate some properties of the above bivariate Poisson distribution. The frequencies of Table I were calculated, using the following values for the parameters:

$$\lambda_1 = \lambda_2 = \cdot 5,$$
$$\lambda_3 = \cdot 4.$$

TABLE I

An Example Illustrating Properties of the Bivariate Poisson Distribution

Period 1	Period 2					
	0	1	2	3	4	
4			.1	.3	.3	.7
3	.1	.6	2.3	3.1	.3	6.4
2	1.4	11.1	23.1	2.3	.1	38.0
1	27.4	112.5	11.1	.6		151.6
0	274.4	27.4	1.4	.1		303.3
	303.3	151.6	38.0	6.4	.7	500.0

The marginal distributions are, therefore,

$$p(x) = p(y),$$

$$p(x) = e^{-.5}\frac{(\cdot 5)^x}{x!}.$$

Calculating the correlation coefficient from the data of Table I leads to $r = .80$. It may be shown from equation [1] that the correlation coefficient of the bivariate population is

$$\rho = \frac{\lambda_3}{\sqrt{\lambda_1\lambda_2}} = \frac{.4}{\sqrt{.5 \times .5}} = .8. \qquad 3]$$

Furthermore it may be shown from equation [1] that the regressions of x on y and of y on x are rectilinear, hence the interpretation of the correlation coefficient as a sloping constant of the regression lines. The regression lines pertaining to the data in Table I are graphed in Fig. 1.

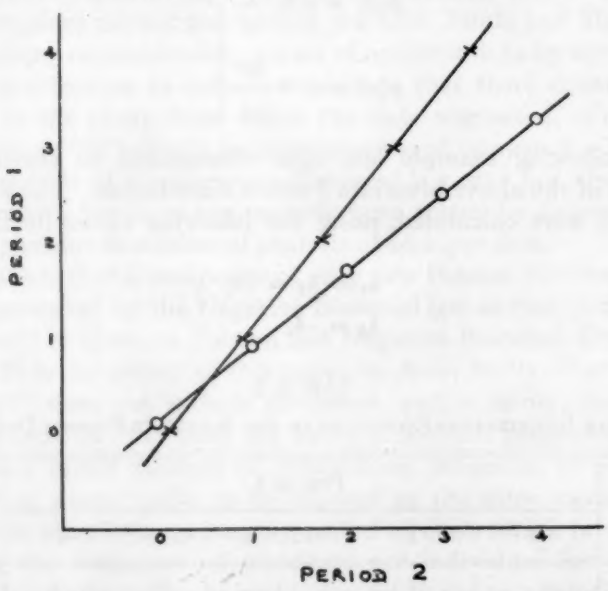

FIG. 1. REGRESSION LINES BASED UPON THE DATA IN TABLE I

The above example shows how wrong our conclusions would have been had we analyzed the distribution of accidents within a single period by the usual procedure of comparing the mean with the variance.

It might be interesting to see what happens if we combine the two successive periods into one longer single period. By adding the fre-

quencies in Table I along the lines 0-0, 1-1, 2-2, etc., we arrive at the following univariate distribution.

No. of accidents	0	1	2	3	4	5	6	7	8	Total
Frequencies	274.4	54.8	115.3	22.4	24.3	4.6	3.3	.6	.3	500.0

mean = 1.0
variance = 1.8

This distribution is not Poisson any more, since variance > mean.

The theoretical distribution, the derivation of which will be published elsewhere, is given by

$$p(z) = e^{-\lambda_1-\lambda_2+\lambda_3}(\lambda_1 + \lambda_2 - 2\lambda_3)^z \sum_{r=0}^{\leq z/2} \frac{\lambda_3{}^r}{(\lambda_1 + \lambda_2 - 2\lambda_3)^{2r}} \frac{1}{r!(z-2r)!}, \quad [4]$$

with mean $= \lambda_1 + \lambda_2 = 1.0$

and variance $= \lambda_1 + \lambda_2 + 2\lambda_3 = 1.8$ [5]

It appears, therefore, that by taking a long enough period of observation we should eventually find such differences between mean and variance as should be indicative of accident proneness, although it may not be sufficient evidence. However, the correlational approach is to be preferred since in practice we can say very rarely a priori how long such a period should be.

Practical Application

The data in Table II were supplied by Adelstein[1], referring to serious

TABLE II

DATA FROM ADELSTEIN'S STUDY (UNPUBLISHED) OF ACCIDENT RATES OF RAILWAY OPERATIVES

No. of Accidents	Observed Frequencies		Theoretical Frequencies		χ^2
0	44		39.7		.466
1	42		44.6		.152
2	21		25.0		.640
3	9	15	9.4	12.7	.416
4	4		2.6		
5	2		.6		
6	0		.1		
TOTAL NO.	122		122.0		1.674

$d.f. = 2$
$P = .44$

[1] Unpublished study.

accidents incurred during a period of five years by 122 railway operatives. The Poisson distribution was fitted to these data and we cannot reject the hypothesis that this sample was drawn from a Poisson population of accidents. We should, therefore, conclude that the accidents were following a pure chance pattern especially since the length of the observational period was considerable. The observed and fitted Poisson distributions are given in Table II.

The accident distribution of the same 122 people for a subsequent period of six years was also available. The chi-square test again revealed that we could not reject the hypothesis of a pure chance distribution. The bivariate distribution of these accidents is given in Table III.

TABLE III

BIVARIATE ACCIDENT DISTRIBUTION BASED UPON ADELSTEIN'S STUDY

PERIOD 1 (YEARS 1–5)	PERIOD 2 (YEARS 6–11)								TOTAL NO.
NO. OF ACCIDENTS	0	1	2	3	4	5	6	7	
0	21	14	8	1					44
1	17	12	8	3	1			1	42
2	6	9	2	2	2				21
3	1	1	3	3	1				9
4	1	3							4
5				2					2
6									
7									
TOTAL NO.	46	39	21	11	4			1	122

The product-moment coefficient as computed from the above table is $r = .29$, which refutes the previous conclusion of no proneness within the group as derived from the chi-square tests of the observed univariate accident distributions. Equation [1] was fitted to the observed data of Table III and the resulting test of goodness of fit gave, for 7 *d.f.*, $P = .49$. Hence it follows that the above data follow a *correlated* bivariate Poisson distribution.

III. NEGATIVE BINOMIAL DISTRIBUTION

If the hypothesis of a Poisson accident law is refuted by the chi-square test, it is customary to proceed to graduate the data by the Negative Binomial distribution. In this section it will be shown that

a good Negative Binomial "fit" need not indicate accident proneness within the group.

Newbold (**4**) gives the relation between the correlation of the accidents within two equal successive time periods and the parameters of the univariate Negative Binomial distribution (representing the frequency of accidents in the combined time period) as

$$\rho = \frac{t}{2p + t}, \qquad [6]$$

where the Negative Binomial law of the total period is defined as

$$p(z) = \left(\frac{p}{p+t}\right)^p \frac{\Gamma(p+z)}{\Gamma(p)z!}\left(\frac{t}{p+t}\right)^z. \qquad [7]$$

The above two equations give us the mathematical rationale for using a good Negative Binomial "fit" as an indication of accident proneness, since a good Negative Binomial "fit" by itself would not suffice to indicate proneness, which by definition is associated closely with correlation. It must be emphasized that the above reasoning is only valid if the parameter p is identical for the combined period and for the two individual shorter periods which are correlated. One may, however, construct a bivariate Negative Binomial distribution of zero correlation; i.e.

$$\left.\begin{aligned} f(x, y) &= p(x)p(y) \\ \text{where} \qquad p(x) &= \left(\frac{p}{p+t}\right)^{p/2} \frac{\Gamma(p/2+x)}{\Gamma(p/2)x!}\left(\frac{t}{p+t}\right)^x \\ p(y) &= \left(\frac{p}{p+t}\right)^{p/2} \frac{\Gamma(p/2+y)}{\Gamma(p/2)y!}\left(\frac{t}{p+t}\right)^y \end{aligned}\right\}. \qquad [8]$$

From equation [8] the distribution law of the accidents incurred in the combined period (variable $z=x+y$) may be deduced; it is identical with equation [7]. From equations [7] and [8] we see that the condition of equal p-constants for the individual as well as for the combined periods is not fulfilled. Hence equation [6] will not hold, and any inference based on Newbold's argument will be erroneous.

A hypothetical example may make the latter point clearer. Suppose that the accidents of one thousand workers were distributed as indicated in the first two columns of Table IV. A Negative Binomial fit of $P=.826$ for 14 degrees of freedom indicates a very good representation of the data.

From the distribution in Table IV we find

$$m_1' = 4.0100,$$
$$s^2 = 19.8959.$$

TABLE IV

HYPOTHETICAL EXAMPLE OF OBSERVED AND EXPECTED ACCIDENT FREQUENCIES

No. of Accidents	f_O		f_E		$f_O - f_E$	$\frac{(f_O - f_E)^2}{f_E}$
0	202		197.6		+4.4	.098
1	161		159.7		+1.3	.010
2	128		128.3		− .3	.001
3	102		102.9		− .9	.008
4	81		82.4		−1.4	.024
5	67		65.9		+1.1	.018
6	52		52.8		− .8	.012
7	41		42.2		−1.2	.034
8	34		33.7		+ .3	.003
9	22		27.0		−5.0	.926
10	17		21.6		−4.6	.980
11	17		17.2		− .2	.002
12	9		13.8		−4.8	1.670
13	14	23	11.0	19.8	+3.2	.517
14	9		8.8			
15	10	20	7.0	12.6	+7.4	4.346
16	10		5.6			
17	5		4.5			
18	3	13	3.6	11.0	+2.0	.364
19	5		2.9			
20	2					
21	4					
22	2					
23		11	11.5		− .5	.022
24	2					
25						
26	1					
TOTAL NO.	1000		1000.0		0.0	9.035

For the estimates of the parameters p and t in equation [7] we find

$$\hat{t} = m_1' = 4.0100,$$
$$\hat{p} = \frac{m_1'^2}{s^2 - m_1'} = 1.0122.$$

Substitution of these values into equation [6] gives us an estimate for ρ, i.e.

$$r = \frac{4.0100}{2.0244 + 4.0100} = .66.$$

From the satisfactory goodness of fit and the high calculated correlation we should conclude that there exists an appreciable amount of proneness in this particular group.

TABLE V

HYPOTHETICAL BIVARIATE DISTRIBUTION OF 1000 ACCIDENT FREQUENCIES

PERIOD 1 (y)	PERIOD 2 (x)																									TOTAL NO.
NO. ACC.	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	
0	202	80	48	32	22	16	12	9	6	5	4	3	2	2	1	1	1	1		1		1			1	450
1	81	32	19	13	9	6	5	3	3	2	2	1	1		1		1		1							180
2	48	19	11	8	6	4	3	2	2		1		1		1		1									107
3	32	13	8	5	3	3	2	1	1		1	1	1		1											72
4	22	9	5	3	3	2	1	1	1	1		1					1									50
5	17	6	4	2			1		1	2		1														34
6	12	5	3		2			1			1					1										25
7	8	4		2	1		1	1		1																18
8	7	3		1		1					1															13
9	5		2		1		1	1																		10
10	3	2	1	1		1	1																			9
11	3	1		1		1																				6
12	2	1	1	1																						5
13	2		1											1												4
14	1	1	1						1																	4
15	1				1		1																			3
16	1	1	1																							3
17	1			1																						2
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TOTAL NO.	451	178	105	70	49	34	28	19	15	11	10	7	5	3	4	2	4	1	1	1		1			1	1000

Mintz and Blum (3) proposed to measure the amount of accident proneness by the "percentage of variance attributable to differences in accident liability," the formula being

$$\text{percentage} = \frac{\text{variance} - \text{mean}}{\text{variance}} \times 100.$$

Substituting our values into this expression we have

$$\text{percentage} = 80,$$

from which we again would infer that we deal with a group in which accident proneness is very pronounced.

Supposing now we split the period of observation into two half-periods, we may arrive at a scattergram as shown in Table V (addition along the lines 0-0, 1-1, 2-2, etc. will again lead to the univariate distribution of Table IV).

For the means and standard deviations of the marginal distributions of Table V we find

Period 1	*Period* 2
$\bar{y} = 2.00100$	$\bar{x} = 2.00900$
$s_y^2 = 10.17900$	$s_x^2 = 9.93892$

$$\frac{1}{1000}\sum xy = 3.90900$$

$$r = \frac{-.11101}{10.05824},$$

$$= -.011.$$

The regression lines of the bivariate distribution of Table V are shown in Fig. 2.

From the above correlation we must infer that the accidents were not caused by individual proneness. This result is in striking contrast to the conclusions based on the usual type of analyses.

IV. Summary

It has been shown that the fitting of theoretical Poisson and Negative Binomial distributions to observed accident data alone is not an adequate criterion for the detection of accident proneness.

It is suggested that the direct technique of "correlating consecutive periods" is indispensable.

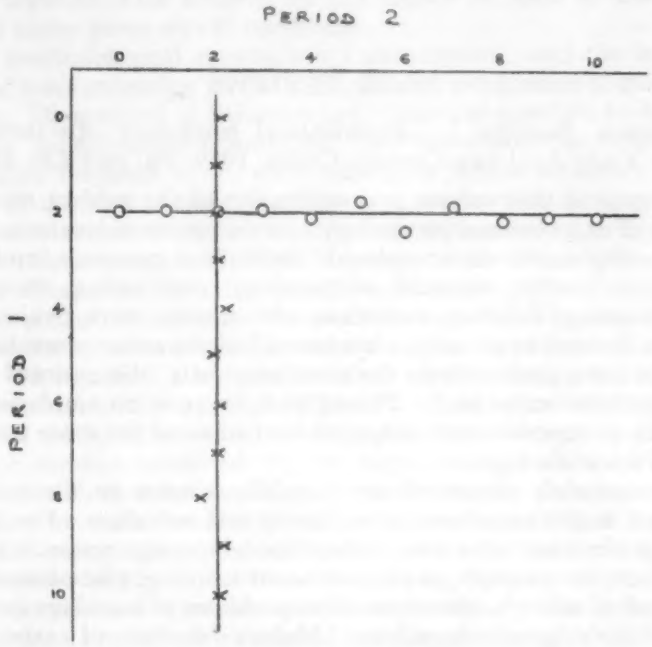

FIG. 2. REGRESSION LINES FOR THE BIVARIATE DISTRIBUTION OF TABLE V

BIBLIOGRAPHY

1. AITKEN, A. C. *Statistical mathematics*, University Mathematical Texts, 2. Edinburgh and London: Oliver and Boyd, 1944.
2. GREENWOOD, M. Discussion of paper: Some statistical aspects of road safety research, by R. J. Smeed. *J. roy. statist. Soc.*, A, 1949, **112**, 25.
3. MINTZ, A., & BLUM, M. L. A re-examination of the accident proneness concept. *J. appl. Psychol.*, 1949, **33**, 195–211.
4. NEWBOLD, E. M. Practical applications of the statistics of repeated events, particularly to industrial accidents. *J. roy. statist. Soc.*, 1927, **90**, 487.
5. PEARSON, K. On certain types of compound frequency distributions in which the components can be individually described by binomial series. *Biometrika*, 1915, **11**, 139–144.

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BOOK REVIEWS

UNDERWOOD, BENTON J. *Experimental psychology: An introduction.* New York: Appleton-Century-Crofts, 1949. Pp. vii+638. $4.50.

The goal of this volume is a unification of the subject matter and methods of experimental psychology. In the course of fourteen chapters the following topics are considered: discriminal processes, motivation, frustration, conflict, transfer of training, conditioning, multiple response learning, thinking, retention, and, finally, work (which is conceived to involve in a complex manner all of the other processes). The materials are organized from the standpoint of a "dimensional analysis of manipulable variables." Throughout, there is an emphasis on the principles of experimental design, and on some of the more basic principles of scientific logic.

The materials presented are carefully chosen to illustrate both sound and faulty experimental reasoning and execution. For the most part, experimental selections reflect contemporary research interests and include, for example, studies of latent learning, place-learning, and the spread of effect, under theoretical problems of learning; under conflict, Miller's gradient-analysis, Maier's studies of experimental neurosis, and Mowrer's demonstration of "regression" are among the examples included. Experiments with applied significance, when they meet the criteria of good design, are given, such as Berger's studies of perception of form, size, and color combinations of number plates, or Woodward's study of transfer of training in industrial operations. The range of problems considered extends to complex processes of human adjustment investigated in such studies as those of ego-involvement, level of aspiration, or of motivational influences on perception. Each of the major topics is organized around the variables which have been experimentally demonstrated, or which may be supposed to influence the process under consideration. Typically, the materials included in the chapter on thinking are organized around the variables of "massed vs. distributed training," "type of material," "set," and "memory factors." Because the basis of the treatment is methodological, work done under divergent theoretical frameworks, such as Hull's, Tolman's, or Lewin's, is readily assimilated into the text without creating any undue impression of inconsistency.

Four types of experimental design are expounded in detail: Method I which employs random groups, Method II which employs groups matched on performance in advance of introducing the experimental variable, Method III which employs complete counterbalancing of conditions, and Method IV which is based on a systematic randomization of conditions. Variations and applications of each method are dis-

cussed, together with criteria for the choice of each of the several methods under given sets of conditions.

The methodological approach is Operationistic, and the treatment gains and loses according to the strengths and weaknesses of this general position. Dimensions of behavior are, wherever possible, to be established by experimental operations. A "dimension" is defined as a stimulus or response scale, some aspect of which is shown to vary reliably in amount. Generalizations tend, under this viewpoint, to be limited to statements of functional relationships between dimensions. However, it is recognized that "a mere correlation of the physical stimulus dimension with the response dimension does not provide a complete picture of the causal factors in behavior." The gap is filled by means of the construct which is defined as "an hypothetical process or state of the organism, the operation of which we infer from observations of the behavior of the organism." Motivation is, according to this view, a state of energization which is inferred from changes in output, or muscular tension exhibited by the organism. Such a construct is viewed as a device for avoiding the necessity for defining particular operations for each "motivational" experiment, making it possible to reduce the many separate operations to a few common factors.

But some of the difficulties involved in carrying through a consistent dimensional analysis become apparent in the course of the writing. In a number of transfer of training phenomena which are contingent on similarity between conditions, the facts simply do not permit a dimensional analysis, as Underwood is careful to state. And in spite of a more or less implicit initial contract that established dimensions will be utilized, it is recognized later that some of the scales must be "improvised." A "motor-verbal continuum" is admittedly a difficult one to dimensionalize because of a lack of comparable units of measurement. The shortcomings of a dimensional analysis become critical, in the reviewer's judgment, in Underwood's attempt to unify the several types of learning—conditioning, multiple-response learning and thinking, which are described as "modal points (presumably on the same continuum) of laboratory operations. . . . We do not assume that there are different *kinds* of learning; the relationships among all tasks used to study learning are too apparent to admit such a distinction *at this time* [italics are Underwood's]. It is a matter for the future to produce the evidence requiring abandonment of this position and establishing the fact that certain distinctions are necessary." The reasoning at this point, the reviewer would contend, is the reverse of accepted scientific logic, which throws the burden of proof for such a priori unification on the theorist. The works of Maier, Jacobsen, Hilgard and Marquis, to cite just a few supports, make it plain that experimentable distinctions do exist between various types of learning situations. Moreover, so far as the reviewer is aware, no generally accepted theoretical resolution of

the problem of "levels" of learning has been accomplished. The substantial advances of contemporary behavior theory over the classical Behavioristic position toward learning have resulted from explicit recognition and refinement of distinctions among *types* of stimulating circumstances, *types* of response, and *types* of learned adaptations. The same point should be made with reference to the interesting speculation that motivational variations be conceived as lying on the same continuum with emotional changes.

In general, the descriptions of experiments are accurate and clear. In a few cases the description is possibly too sketchy for complete comprehension, as in the discussions of delayed response or of Maier's reasoning experiments. In the summary of an experiment by Bugelski on derived reinforcement, the sense is lost because it is stated that the experimental and control animals are both trained and tested under the differential conditions. Actually both groups were exposed to the same conditions during acquisition of the habit, but during extinction the derived reinforcing stimulus was omitted for one group and retained for the other. But in view of the large mass of detailed experimental materials summarized, there are very few inaccuracies.

It is the reviewer's opinion that the book offers a set of highly worthwhile background materials for a strong course in experimental psychology. The type of need which it fulfills for the student is seen clearly in the sections dealing with extrapolation from data obtained with animals to human behavior, and in the discussion of guides for scientific generalization, both of which could be reviewed with profit by many of us who enjoy being thought of as experimentalists. Those who have concluded, with the reviewer, that courses in the physical sciences frequently *fail* to imbue students with an understanding of scientific method, and who feel, consequently, that developing skill in the application of scientific modes of thought to complex problems of human nature and social interaction is a task that falls to the psychologist, will be quick to sense the value of Underwood's effort.

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STAGNER, ROSS. *Psychology of personality.* (Rev. Ed.) New York: McGraw-Hill, 1948. Pp. xiii+485. $5.00.

Ross Stagner has completely revised his 1937 text on personality and now presents a longer, more inclusive, more systematic and, in the eyes of the present reviewer, a more gracefully written book.

The new edition, like the old, is organized into four major sections. Section I, *Introduction*, disposes of the definition of personality and devotes two chapters to methods. Section II, *Description of Personality*, includes material on structure, organization, learning, traits, the self, character, attitudes, expressive movements, and types. Section III, *Dynamics of Personality*, talks about the biology of motives, briefly

presents Freud, Adler, Lewin, and Allport, and works up to the author's synthesizing chapter on "A Cultural Interpretation of Motivation." Section IV, *Determinants of Personality*, presents material on biological factors, the family, the school system, economic factors, and on the relation between personality and social values.

The new book includes expanded treatment of several specific topics that have recently been receiving more attention. For example, the problems of reliability and validity are dealt with much more adequately than in the 1937 book, and there are now seven pages on "projective techniques" instead of one page on "the ink-blot test." But more important than the inclusion or expansion of specific topics are changes in general approach. For one thing, the author has taken into his thinking the concept of *frame of reference*, and with it, an increased attention to perceptual phenomena in personality. He has also stopped worrying as to whether personality is stimulus or is response, and has come to think quite comfortably in terms of intervening variables.

These changes in content and approach mean that the new book, more than the old, contains the raw material out of which the author's intended "adequate picture of the field" can be made. Whether the author paints an adequate picture may be open to debate. Those psychologists who are down with a rigid adherence to one or another conceptual approach to personality will not like the book's eclecticism. Others will be unhappy with the way in which the conceptual ingredients of the picture are arranged and presented.

The present reviewer, through the first 275 pages of the book, was bothered and puzzled by what appeared to be a tendency on the part of the author to enumerate rather than to relate various concepts—a tendency which will probably confuse all students and many instructors. For example, in dealing with the concept of *trait*, the author writes, "We need not necessarily consider the interpretation of traits as frames of reference to exclude either habit-systems or the mental-set interpretation. Each in its own way may help the student to grasp the functional character of traits" (p. 146). Such a *laissez-faire* approach to overlapping or closely related concepts tends to be repeated in the case of attitude, stereotype, and frame of reference, and to some extent in the early dealings with drive, valence and tension. Things seem to come out all right in the end, but the ride over the conceptual road is jerkier than one would wish—either for himself or for his students.

It is not a pretentious book. It is a book around which a good and comprehensive course in personality can be built. It is this reviewer's guess that students' reaction to the book will be generally favorable and that they will find the chapter on the social determiners of personality particularly provocative. By and large, the book seems to do what it sets out to do—to give the student "an adequate picture of the field, not a tightly organized theoretical interpretation" (p. vii).

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SHELDON, WILLIAM H. (with the collaboration of E. M. HARTL AND E. MCDERMOTT). *Varieties of delinquent youth.* New York: Harper, 1949. Pp. xvii+899. $8.00.

This volume, the third in a projected series on Human Constitution, continues Sheldon's well known work on constitutional psychology. The first section of the book consists of an "orientation for a biological humanics." Next follows a section of some 600 pages containing abbreviated case histories complete with the somatotyping pictures and measurements of 200 delinquent youths studied at the Hayden Goodwill Inn in Boston. The final section discusses the psychiatry of delinquency. The book ends with a three-page epilogue which calls for a sweeping reorientation in our economic, political, sexual, and religious thinking, since "the problems presented by delinquency are inseparable from the underlying defections of social institutions."

The student of Sheldon's morphological doctrines will find here an application of his somatotyping technique to 200 subjects, a further development of the psychiatric implications of his constitutional approach, and an attempted application of them to the problems of delinquency. He will also find many stimulating and suggestive comments, although they seldom are buttressed either by original scientific data or by authoritative citation from the literature. To reach them he will have to wade through many pages of somewhat ill-tempered, authoritarian pronouncement which often ranges far beyond the topic presumably being discussed.

One feels that Sheldon has achieved not a careful scientific handling of an important topic, but rather a personal philosophical catharsis. The style is marked by a petulant omniscience that is irritating at first but finally ends by becoming unintentionally amusing. This reviewer deems it unfortunate that the author did not discipline himself to his scientific task. The publication of this book will do little to further an important and suggestive approach to human behavior, an approach already under heavy and sometimes undeserved critical attack, and ill-prepared to withstand the further criticism that Sheldon's performance will inevitably arouse.

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NOTICE

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